TRAFFIC QUARTERLY

AN INDEPENDENT JOURNAL FOR BETTER TRAFFIC

JANUARY 1954

Speed Control
Few Drive Their Best
State Aid for City Streets
Parking in Washington, D. C.
Business Aids Traffic Problems
Unified Approach to Traffic Safety
Motorists and Today's Highways
Vehicular Trip Distribution
New Zoning in Old Cities
Virginia State Police
Sixty-two Cities
Toll Bonds

THE ENO FOUNDATION FOR HIGHWAY TRAFFIC CONTROL

EDITORIAL STAFF

Editor-in-Chief — Col. Robert C. F. Goetz, *U. S. A. Retired*

Executive Editor — Roscoe Ellard, Director of Instruction, *Graduate Journalism Faculty, Columbia University*

Associate Editors — Wilbur S. Smith, *Traffic Engineering*
Charles M. Upham, *Highway Engineering*
Robert E. Schmidt, *Resident Traffic Engineer*

Editorial Assistants — Mary S. Briody
Charlotte K. Munger

Permission to reprint articles from this magazine may be obtained without charge on request to the publishers, Eno Foundation, Saugatuck, Connecticut. Publication of this magazine is provided by income from an endowment by the late William P. Eno.

Volume VIII, Number 1 January, 1954

PRINTED BY COLUMBIA UNIVERSITY PRESS, NEW YORK, N. Y.

Traffic Quarterly

TABLE OF CONTENTS, JANUARY 1954

Too Few Drive Their Best 3
COLONEL ROBERT C. F. GOETZ

Speed Control by Traffic Signals 5
G. ALBERT HILL

More State Aid for Our Local Highway Improvements? . . 13
GEORGE M. RAYMOND

Business Aids Traffic Problems 23
WILBUR S. SMITH

A Tale of Sixty-two Cities 33
MAYNARD A. BEBEE

Parking in Washington, D. C. 36
CHARLES M. UPHAM

The Virginia State Police and Problems of Traffic Policing . . 42
COLONEL C. W. WOODSON, JR.

Vehicular Trip Distribution by Successive Approximations . 53
THOMAS J. FRATAR

Marketability of Toll Bond Issues 66
J. L. JEFFERS

What Does the Motorist Expect of Today's Highway System? . 76
K. B. RYKKEN

New Zoning for an Old City 84
A. RUSSELL TRYON

Studying the Unified Approach to Traffic Safety 92
WALTER A. CUTTER

Copyright 1954, by the Eno Foundation for Highway Traffic Control, Inc. All rights reserved under International and Pan-American Copyright Conventions. Reproduction of Traffic Quarterly articles in whole or part without permission is strictly prohibited. Published quarterly by the Eno Foundation at Saugatuck, Conn., issue for January, 1954. Printed in U.S.A.

Too Few Drive Their Best

SEVERAL Traffic Quarterly articles have been directed at driver-improvement. The basic thought has been that improved drivers would improve driving—which in turn would improve our inefficient use of highways.

Driver-improvement can be partly accomplished by realistic qualification tests, practical enough to prevent the "qualifying" of incompetent drivers for our greatest highway menace, *poor driving.* That accomplishment would be economical, historic and humane. A permit to drive should show in understandable language the terms under which the license was issued and provisions for its withdrawal.

Many drivers fail to drive as well as they know how. If their *manner of driving* indicates their driving *ability* or their moral *responsibility,* it is time to provide urgent measures for better screening. The issuance of a permit assumes a trust that its holder will drive according to his best judgment and ability. Our permit assumes we will control untoward mental tendencies and emotions as well as our car.

This brings us to *driver attitude* in driving. That *attitude* may come to be an important factor in the issuance of driving permits. From research studies and experiments made in this subject have come interesting results. Some findings are startling when we consider that under our present system of licensing, approximately seventy percent of the accidents in an average year involve faulty driving.

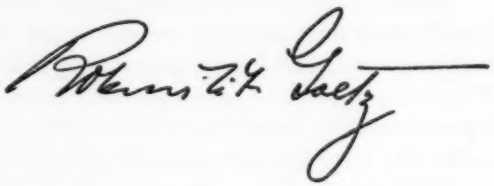
Many of the faults are as simple as ignoring signs or driving on the wrong side of the white line. They seldom come from lack of intelligence, lack of driving ability, or physical defects of car or driver. Mainly they are willful and lead to serious consequences. They clearly mark one's *driver attitude.* It is a difficult problem in traffic control and regulation. These personality or character faults contribute to poor attitude toward poor driving.

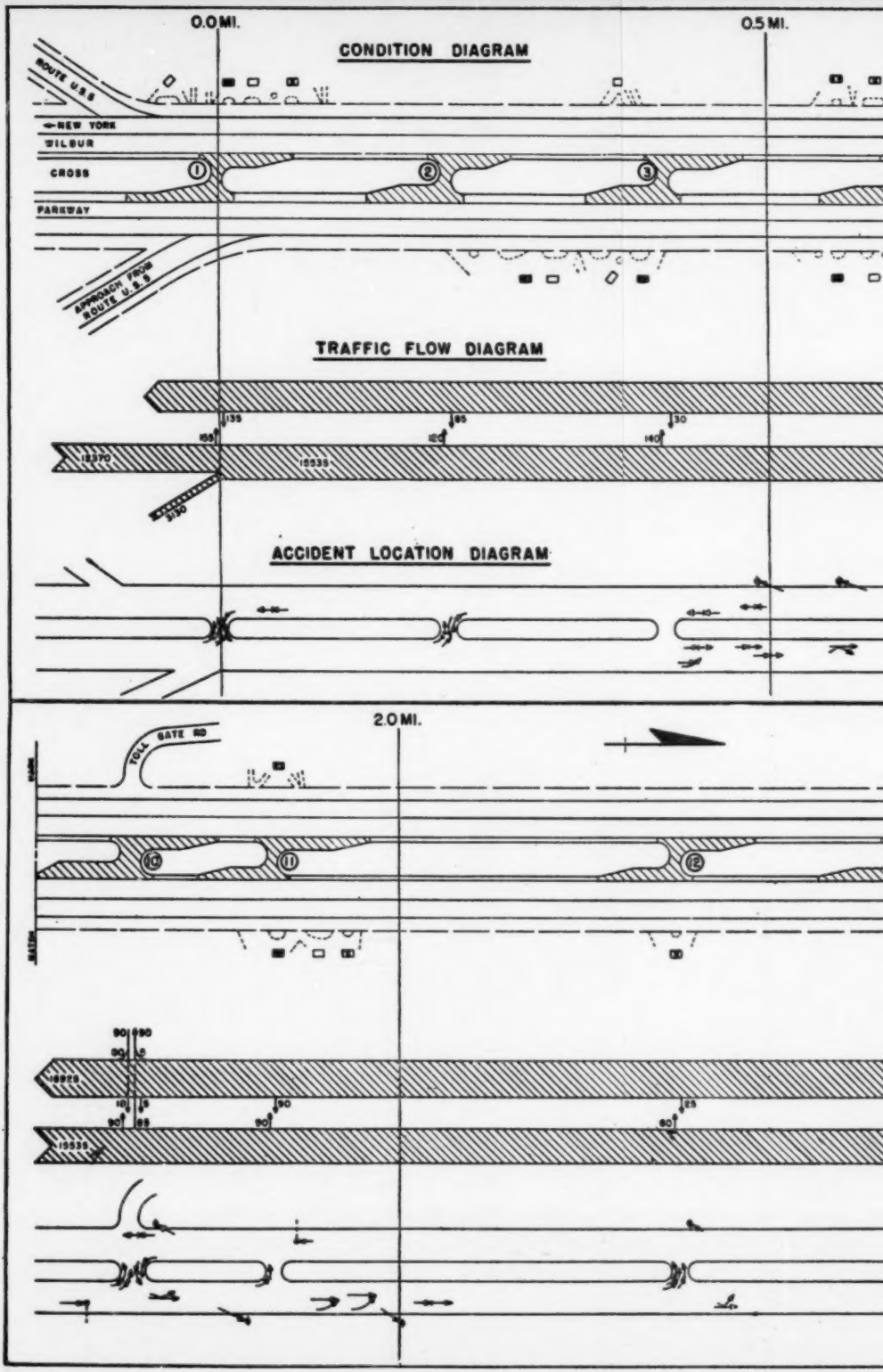
Next to poor drivers, comes the lack of uniformity in traffic aids and controls. Even a good driver who is conscientious can easily be-

come confused by a multiplicity of unintelligible, conflicting, and unnecessary—though well-meant—aids.

To meet the problem of *driver attitude* is a challenge to licensing, enforcement, and the judiciary. These agencies have been slow to integrate their knowledge, powers, and efforts. They deserve the public's sympathetic aid and objective support.

We do most things too well to drive badly.




0.0 MI.
0.5 MI.
CONDITION DIAGRAM
ROUTE U.S.5
NEW YORK
WILBUR
CROSS
PARKWAY
APPROACH FROM ROUTE U.S.5
TRAFFIC FLOW DIAGRAM
ACCIDENT LOCATION DIAGRAM
2.0 MI.
TOLL GATE RD

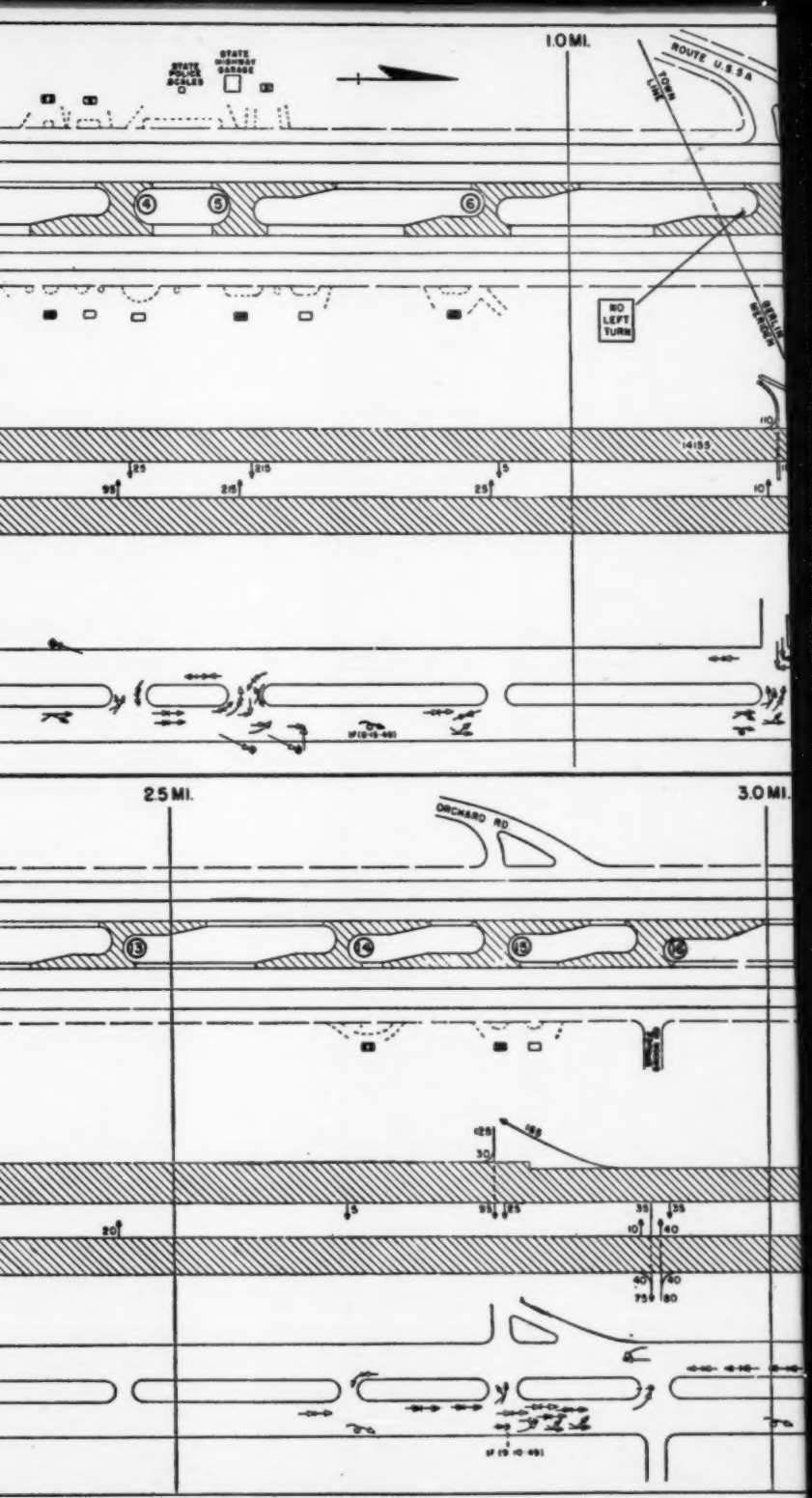
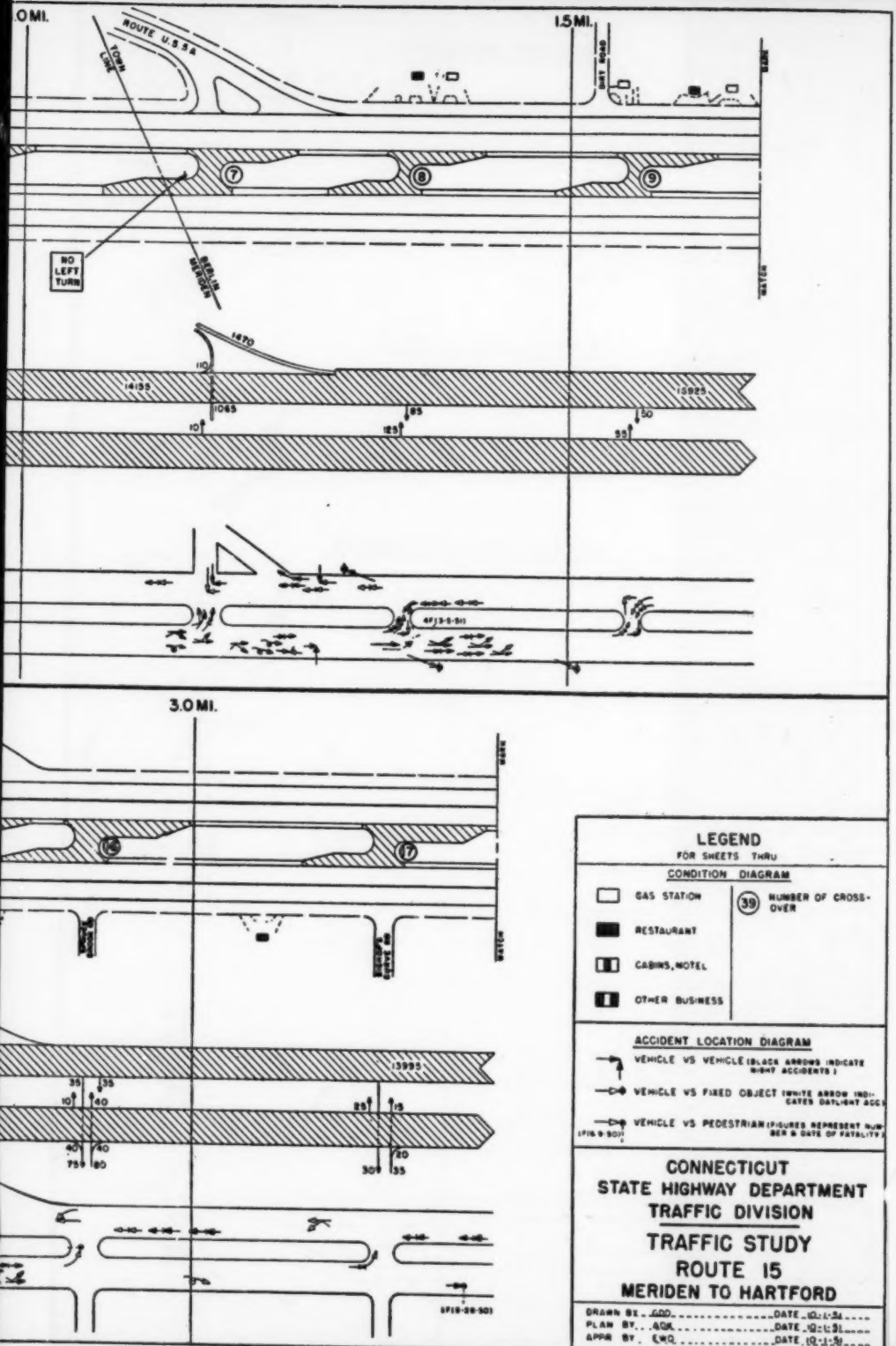


FIGURE 1. A Study of Traffic Conditions on Berlin Turnpike.


0 MI.
1.5 MI.
3.0 MI.
ROUTE U.S.5A
TOWN LINE
NO LEFT TURN
BERLIN
MERIDEN
DIRT ROAD
WATER
7
8
9
16
17
1470
14150
13925
13995
1065
LEGEND
FOR SHEETS THRU
CONDITION DIAGRAM
GAS STATION
RESTAURANT
CABINS, MOTEL
OTHER BUSINESS
39 NUMBER OF CROSS-OVER
ACCIDENT LOCATION DIAGRAM
VEHICLE VS VEHICLE (BLACK ARROWS INDICATE NIGHT ACCIDENTS)
VEHICLE VS FIXED OBJECT (WHITE ARROW INDICATES DAYLIGHT ACCI
VEHICLE VS PEDESTRIAN (FIGURES REPRESENT NUMBER & DATE OF FATALITY)
CONNECTICUT
STATE HIGHWAY DEPARTMENT
TRAFFIC DIVISION
TRAFFIC STUDY
ROUTE 15
MERIDEN TO HARTFORD
DRAWN BY GDD DATE 10-1-51
PLAN BY AGK DATE 10-1-51
APPR BY EMQ DATE 10-1-51

Speed Control by Traffic Signals

G. ALBERT HILL

Dr. Hill has been Connecticut State Highway Commissioner since 1948. Formerly an instructor in chemistry at Harvard, later professor of chemistry at Wesleyan University, Connecticut, he is a member of the Northeast Association of Chemistry Teachers, a member of the American Association of Highway Officials, and a recipient of the President's Certificate of Merit. He is president of the Association of State Highway Officials of the North Atlantic States, and regional vice president of the American Association of State Highway Officials.

THE Berlin Turnpike, so called, is a 12.3 mile section of Route U. S. 5 in the Connecticut towns of Meriden, Berlin, Newington and Wethersfield. This four-lane, divided highway with intersections at grade, runs in a northerly direction from the intersection of the Wilbur Cross Parkway and Route U. S. 5 in Meriden to the Hartford-Wethersfield town line, and is the only "free access" portion of the main route from New York City to Hartford. Location, geographically and traffic-wise, plus unlimited access has resulted in extensive marginal development.

Accident and fatality rates per 100 million vehicle miles on the Turnpike for the two-year period 1949–50 were below the statewide averages for all types of roads, but a number of spectacular accidents resulted in considerable adverse publicity. So much so, that this portion of Route U. S. 5 was often referred to as "Death Alley."

Committees, formed in each town that the Turnpike traverses, requested the State Traffic Commission to conduct a study of traffic conditions on the Berlin Turnpike. A comprehensive operational study was inaugurated by the traffic division, Bureau of Traffic-Planning-Design, with detailed analyses of roadway physical characteristics, operating speeds, vehicle volumes, accidents and driver behaviors. (Figure 1.)

General Characteristics: The Turnpike is a four-lane, divided highway whose medial divider varies in width from nineteen to sixty

feet and, until recently, was dotted with frequent crossovers. Travel lanes are ten to thirteen feet wide with concrete, bituminous treated, or armor coat, surfaces. Outside shoulder areas range from two to nine feet and inside gutter strips are from two to seven feet wide.

Crossovers and Median Lanes: There were sixty-four crossovers (paved connectors between northbound and southbound roadways) on the 12.3 mile section involved. Deceleration lanes at certain of these crossovers varied from an eleven-foot width for a length of 225 feet and a 175-foot taper section to an eight-foot width for a length of 125 feet with a 175-foot taper. The twelve crossovers from the south junction of Route U. S. 5A (Worthington Ridge) to the north junction of Route U. S. 5A in Berlin had no deceleration lanes. The recently constructed deceleration lane for northbound traffic at the south junction of Route U. S. 5A (Worthington Ridge) is thirteen feet wide for a length of 334 feet and has a 101-foot taper. The bituminous-surface sections of the Berlin Turnpike had no effective deceleration lanes. There are three grade separations located at the intersections of Route Conn. 72, 175, and the South Meadows Expressway southbound roadway.

Alignment: The alignment is generally straight, there being but two curves on this road with a degree of curvature in excess of two degrees. The first is a three-degree curve to the right (traveling north) 300 feet in length in the northbound roadway just south of the intersection with Meadow Lane in Berlin. The other is a five and one-half degree curve to the right (traveling south) 250 feet in length in the southbound roadway just north of the intersection with E. Robbins Avenue (State Road 760.) All curves have a safe maximum speed in excess of 50 m.p.h. as determined by ball-bank indicator trial runs.

Gradient: The gradient of the turnpike follows a rolling terrain with no substantial difference in elevation from south to north. There is one grade greater than five per cent extending a distance in excess of 500 feet. This is a 6 percent grade 1200 feet long 1400 feet north of Webster Road in Newington.

Sight Distance: Sight distances in general may be considered as adequate, the shortest sight line being a 500-foot restricted sight distance at the crest of a vertical curve on the northbound roadway at the old railroad bridge just south of the intersection with Route 160.

Accident Experience: An analysis of all available data for the two-year period 1949–50 led to the following conclusions:

1. The accident rate (328 per 100 M.V.M.) for a four-year period, 1946–1949, is below the statewide average (430 per 100 M.V.M.) for the same period. The fatality rate (9.7 per 100 M.V.M.) for the period 1946–1949 is higher on the Berlin Turnpike than the statewide average (6.5 per 100 M.V.M.) for all four-lane, divided highways.

2. The accident frequency at the crossovers between intersections is high in comparison to crossovers at intersections.

3. Fifty-one percent of the accidents occurred during the hours of darkness as compared with the statewide average of 42.9 percent for the same period.

4. Thirty-seven percent of all accidents were of the rear-end type indicating that speed, plus inadequate median lanes, is a predominant causation factor.

Speed Checks: Speed observations conducted at fourteen locations were chosen so as to give a representative sample of speeds along the Berlin Turnpike. A total of 2,900 observations were taken and in most cases 100 observations were made in each direction of travel.

The road was posted for 40 and 45 m.p.h. speed limits but the majority of drivers did not observe this limit. Observations indicated that operating speeds are higher at the southerly end of the highway, probably due to the better roadway at that end.

Traffic Volume: The estimated 1951 A.D.T. varies from 30,000 vehicles at the south end in Meriden, to 35,000 vehicles at the junction where Route U. S. 5 bears east toward the South Meadows Expressway. Approximately 14 percent of this traffic is composed of commercial vehicles. The peak hours are 3 to 5 P.M., with lower peak hours at 7 to 9 A.M. and 7 to 8 P.M. Field data indicated a rela-

tively small use of crossovers, and no major intersecting streets generating high volumes which would either cross or enter Route 5. The 12 noon to 4 P.M. period appears to be that part of the day when motorists make greatest use of crossovers.

Signal Installation: A careful analysis of the foregoing field observations and studies of vehicle maneuvers resulted in several conclusions: one, that a reduction of operating speeds to a level commensurate with the type of traffic and the highway's geometric characteristics was necessary and could be effected by installing an interconnected progressive system of traffic signals.

With the above in mind, the Traffic Division designed and installed a progressive network of eighteen fixed time signals. Spacings in the network averaged 3300 feet, with a minimum distance of 318 feet and a maximum of 5737 feet between signals.

Billboard type signs advising motorists of the signal system were erected on the Turnpike at its northern terminus, and on the Wilbur Cross Parkway, just south of the Turnpike. Smaller signs are distributed over the entire length of the Turnpike, advising motorists who enter the highway at intermediate points, of the signal network. A typical installation is shown in Figure 2.

All signals are three color and span wire mounted over the center of each roadway. They are interconnected by telephone circuits and governed by a master controller. Manual operation is provided for at specific locations where local needs require it.

The 85-second cycle was chosen as most advantageous for intersectional requirements and for the progressive movement of traffic at 45 miles per hour.

"Go" intervals vary with local conditions, but amber phases are generally eight seconds on the main artery and three seconds for cross traffic.

Effectiveness of Signals

Before discussing the operational effectiveness of the progressive signal system, two important factors should be noted.

1. The average signal spacing of 3300 feet is two and three-quarter times as great as the 1200-foot interval recommended by the

FIGURE 2. Signs Advise Motorists of Signal System on Berlin Turnpike.

FIGURE 3. Section of Route 15 with Bituminous Surface (right) Now Being Replaced.

"Manual on Uniform Traffic Control Devices" and one and one-third times the 2500 feet noted in the "Traffic Engineering Handbook."

2. Reconstruction of many portions of the Berlin Turnpike has necessitated turning some of the signals to flashing operation for extended periods.

Despite these long spacings, frequent interruptions due to construction, and the relatively brief period of operation, there is considerable cause for optimism. Speed observations using a Radar Speed Meter and Easterline Angus pen recorder, were conducted prior to the signal installations at nine locations involving various roadway characteristics and different distances from proposed signal locations. Results at all stations followed a definite pattern of a majority of speeds in excess of the posted limit, some more than sixty miles per hour, and little or no platooning of vehicles. The latter condition attains critical importance when one considers the multitude of roadside business establishments and the resulting number of vehicles entering the highway at random locations.

Similar observations at these same stations after the signal system had been put into operation revealed a six miles per hour reduction in the average speed of vehicles. Where vehicle-travel in platoons was the exception before the signalization, it is now the rule.

An examination of before and after speeds at station number 2, five hundred feet from the signal at Orchard Road, as shown in graphical recording of radar observations, gives a clear picture of the changes effected by the progressive signal network.

The *before* observations indicate the random movement of vehicles. The majority of speeds exceeded 45 mph, many are above 50 mph, and some even greater than 60 mph. The graph reveals the predominance of the platoon system and a minimum of vehicles traveling above 45 mph *after* signalization. The latter amounted to approximately six vehicles in the ten-minute period recorded.

A typical comparison of cumulative speed curves was made from observations conducted two hundred feet south of the Sebethe River, and some 1,700 feet south of the signalized intersection at Route 160 in Berlin. The southbound pavement is concrete and in good condition; the northbound lane has a bituminous surface which

was in a poor condition and is now in the process of being replaced. (Figure 3). Speed observations conducted June 29, 1951 prior to signalization revealed average speeds of 49.6 mph (northbound) and 47.8 mph (southbound). Comparative speeds recorded April 15, 1953 after institution of the signal system were 44.8 mph and 45.3 mph.

Two items of particular significance revealed by the cumulative speed curves are:

a. The pace bracket for *after* speeds averaged 80 percent of the total observations while the like percentage for *before* speeds was 56 percent. This indicates safe and efficient movement of traffic through better observance of posted speed limits, smaller speed differential, and the travel of vehicles in the platoon system.

b. It is also to be noted that 70 percent of the vehicles exceeded the posted limit prior to signalization. Percentage of violators after signalization is only 43.

Time-distance trial runs over the 12.3 mile-length of the Berlin-Turnpike further indicated the efficiency of the progressive signalization. Running times averaged fifteen minutes before, and eighteen minutes after, the installation. The increase of three minutes in total travel time is negligible when one considers the length of highway involved and the freedom of movement effected by the signal network. The latter item is of particular importance when one considers the dense marginal development on the Turnpike and the frequency of motorists entering the highway.

Accident Records Compared

Past experience with traffic signal installations proves that with the inception of such a traffic control, accident occurrence has a tendency to increase. It also reveals that the accident pattern changes, i.e. more rear-end collisions after installation as against angle and turning movement accidents before. Generally, accidents resulting from the angle or turning movement are of greater severity than the rear-end collision type. Thus one factor offsets the other. Though the number of accidents increase, the severity decreases, a result which is a definite improvement.

It does not necessarily follow that an increase in accidents remains the pattern, however. Post-installation studies have shown that in some cases the accident curve declines as traffic becomes accustomed to the change.

The accident frequency during the months of April through July, 1952 averaged twenty-four per month. The frequency for the first month of signal operation was more than twice this average; but after four months of operation, the monthly occurrence was less than the monthly average for the 1952 period.

An analysis of available figures shows that turning accidents have decreased 75 percent from the preceding year, and accidents involving vehicles moving at right angles to each other have been eliminated.

Gaps in traffic as effected by the operation of the signal network have facilitated the entry of vehicles to the highway from roadside business establishments. As a result, accidents involving this type of movement are almost non-existent.

Property damage rates are as yet unavailable, but it can be assumed that with the greater incidence of rear-end collisions in replacing turning movements, severity of accidents has also decreased. Thus, if the trend in the number of accidents remains relatively constant with the preceding years and the severity lessened as outlined above, the success of the new signal system is assured. Cause for optimism was indicated by a recent comment made to the Traffic Division when all signals were inoperative due to a temporary power shutdown. School bus operators phoned to complain that the signals were not working and they found it extremely difficult to enter the highway.

Summary

There was some speculation about the capacity of the Turnpike as affected by the signalization. Observations have revealed higher volumes of traffic using the highway after the system was put into operation than before. Even during the peak exodus from Hartford during the late afternoon, the first signal encountered at Sanatorium Road does not create undue congestion. Each "Go" phase for the main artery has been sufficient to clear all waiting vehicles plus

additional traffic. The average headway at this location is close to two seconds.

The conclusion to be drawn from the data made available by the Berlin Turnpike Progressive Signal is that:

"The efficient movement of large volumes of traffic at lower speeds without abnormal delays can be effected by a progressive signal system, in spite of the fact that some of the signal spacings are greater than one mile".

More State Aid for Our Local Highway Improvements?

GEORGE M. RAYMOND

Mr. Raymond is director of planning with a New York engineering firm and lecturer in planning at Pratt Institute in Brooklyn, N. Y. He was a consultant in the preparation of master plans and urban redevelopment plans under Title I of the Housing Act of 1949. He is an associate member of the American Institute of Planners.

RECENT traffic survey findings and statistical analyses seem to have established conclusively that 1. the overwhelming majority of all automobile trips originate and end in the heart of urban areas; 2. most motor trips cover only a few miles; and 3. a substantial percentage of all vehicle accidents occurs on urban streets.[1]

It is strange to find therefore that by far the largest share of available highway construction funds is being spent on the building of rural highways, expressways, and by-pass roads that primarily benefit long-range traffic, with only a relatively insignificant percentage devoted to the improvement of urban through-streets.[2]

Table I shows the present sources of highway financing. In this connection the following significant facts should be noted.

1. Of the $625 million contributed by the federal government, only $137 (or 21.9 percent) are spent on urban roads. This statement must be further qualified, since the type of project generally financed with federal aid is the thruway rather than capital improvement of the cities' over-worked through-street system.

2. Of the $2,800 million raised by the states, only $137 million (to match the federal appropriation) are definitely earmarked for urban road programs. In addition, only an infinitesimal amount is distributed to cities through local aid programs. However, a sub-

[1] The Virginia Department of State Police reported that in 1950, 44.2 percent of all motor accidents occurred in urban areas, with 35.1 percent in cities of 10,000 population or over. (Virginia Traffic Accident Facts, 1950, the Department, Richmond, Va.)

[2] The term "through-streets," as used in this article, denotes improved arterial streets or highways without control of access on which preference is given to through traffic and which provide the most direct connection between important traffic-generating sections of the city.

stantial percentage of such local aid funds is spent for purposes other than capital improvements.[3]

Table I

PRESENT HIGHWAY FINANCING
(in millions)

Federal Aid	$ 625
State Highway User Revenue	2,800
Other Revenues (including capitalized tolls of authorities and similar bodies	225
Municipal Government Expenditures	1,110
Sub-Total	$4,750
Less maintenance and administration	2,050
Total available for construction	$2,700

Source: How to Plan and Pay for the Safe and Adequate Highways We Need, by Robert Moses. Prize-winning essay, 1953 General Motors contest.

3. Most Authorities use their funds for toll facilities which either by-pass cities or provide bridges, tunnels, etc., the net effect of which is usually an ever-increasing traffic flow into downtown areas.

4. Fifty-eight percent of the funds spent on urban streets is devoted to meet the cost of administration and maintenance as against 33 percent so spent of the funds expended on state highways. (See Table II).

Table II

1951 ESTIMATE OF EXPENDITURES FOR HIGHWAY AND STREET PURPOSES BY FEDERAL, STATE AND LOCAL GOVERNMENTS IN CONTINENTAL UNITED STATES
(in millions)

Expended on	*Total Expenditure*	*Capital Outlays*	
		Total	*Percent of Total Expenditures*
State highways	$2,612	$1,764	67%
Local rural roads	1,024	357	34%
Urban streets	863	385	42%
Totals	$4,499*	$2,506	57%

* Excluding $42 million in unclassified federal expenditures.

Source: Highway Finance 1951, U. S. Department of Commerce, Bureau of Public Roads.

[3] A bill passed by the Connecticut legislature in 1953 specifically authorized towns to use state aid highway grants for snow removal, road sanding, caring for trees, and installation of traffic signs and signals.

The analysis above suggests that an explosive situation may be building up in the increasing gap between road use and capital expenditures in urban areas; that the current approach toward solving the nation's highway problems will probably fail as long as it fails to attack those problems where they are most acute—on urban streets; and that the solution probably lies in a redistribution of state highway fund expenditures, since the forty-eight states are the greatest source of highway construction funds. It is claimed herein that there is ample justification for the earmarking of a larger percentage of state highway funds for improving city through-street systems; that improvement must not be thought of exclusively in terms of spectacular through-highways, but rather that more attention must be paid to mundane features of street widening, eliminating street jogs, improving intersections, providing adequate space for effective traffic channelization, and the like; and that, despite the high cost per mile of such improvements, they must be undertaken soon if cities are to continue to function.

Subsidy Needed as in Slum Clearance

It is common knowledge that for one reason or another state legislatures are loath to assume responsibility for urban programs of any sort. The stress today is on decreasing, rather than increasing, financial reliance on higher levels of government. Yet at the same time, the precise delimitation of responsibility of various levels of government in matters that affect the welfare of the people is becoming increasingly difficult. This is particularly so in society like ours which is experiencing the explosive effects of unprecedented dynamic technological development.

A clear example of the expanding concept of governmental responsibility is provided by the current federal subsidies to local governments in slum clearance and urban redevelopment. The basic finding behind this federal activity is that slums are a cancerous growth on our physical and social fabric and that their existence inhibits the healthy development of the nation's municipalities and, through them, of the nation as a whole. Having accepted this premise, the sole question to be answered was whether private enter-

prise and local governments were able to perform, unaided, the surgical operation necessary for slum removal. It did not take long to establish the fact that such ability did not exist on an adequate scale, and that federal subsidies in one form or another were the only possible answer.

The question of state participation in local highway improvement programs must therefore be similarly decided on the basis of whether an emergency exists and whether it can be resolved satisfactorily by the local governments directly affected. Determining whether the emergency is due in larger or smaller degree to factors originating beyond municipal boundaries can serve merely as a corroborating factor. Referring to the example above, the existence of slums is unquestionably a purely local factor, the responsibility for which clearly lies with the municipality for its age-long condoning of shoddy construction and for its lack of enforcement of building and health codes.

That current traffic congestion on city streets does constitute an emergency needs no demonstration. Its recognition at the federal level is implicit in an ever-increasing but still grossly inadequate percentage of federal highway-aid funds earmarked for urban highways. Traffic congestion is responsible for countless accidents. It represents yearly financial losses worth billions of dollars in man-hours wasted, in uncontrolled fires from inability of fire equipment to move quickly along city streets, and in unnecessary wear and tear of equipment.

Traffic congestion is also the accepted reason for the current virtual explosion of cities. The overspill of business and population into suburban areas has the effect of increasing the load on urban highways, since the continued attraction of the central city as a focus of employment and business opportunity remains undeniable. At the same time, this flight from the city reduces the urban tax base, and thereby diminishes the city's ability to pay for needed improvements.

Municipal Funds Inadequate

If analysis of municipal budgets revealed a misuse of funds on a large scale or if municipalities were engaged in spending for un-

necessary luxuries, the state legislature could rightly insist that the emergency could be solved through better management of municipal funds. However, the uniform situation throughout the country is that municipalities, despite increased taxes, are already desperately, and somewhat hopelessly, struggling with problems of staggering proportions. The ever-rising birth rate calls for unprecedented school construction and operating appropriations. The essential but long-neglected rejuvenation of the urban physical plant (including the provision of basic health, sanitary, and administrative facilities needed for more efficient administration) added to the expansion of municipal services into rapidly urbanizing fringe areas, represents another substantial drain on the municipal pocket book.

To this must be added the cost of providing recreational and cultural facilities demanded by a population increasingly conscious that "man lives not by bread alone". None of these problems have been adequately solved anywhere. Most municipalities are engaged in desperately juggling funds to meet only the most pressing immediate demands. The result is that demands temporarily neglected become pressing soon enough to prevent any from being adequately satisfied.

The practice of raising the lion's share of municipal revenues out of realty taxes makes it exceedingly difficult for municipalities to solve their problems, including highway and traffic problems, unaided. There is a limit to the amount of taxes real estate can bear and still remain a profitable private enterprise. Even more serious is the fact that increased tax rates have a particularly painful impact on the small homeowner. It is entirely unreasonable that the small homeowner should be asked to place the relief of congested downtown areas ahead of many of the problems which concern him much more closely. All these almost universal deficiencies of the urban plant constitute civic emergencies equal to or surpassing that presented by traffic congestion, and their correction could only be neglected at the risk of gravely affecting the general welfare.

Many other factors can contribute to the strengthening of the principle advanced herein, depending upon the particular function of a municipality with respect to its metropolitan area. Thus many cities are shopping centers serving substantial regions. While re-

sponsibility for layout of streets in the actual shopping district, regulation of traffic and parking therein as well as provision of adequate off-street parking facilities, should rest solely with the municipality, provision of an adequate primary highway network from city limits to the shopping district is distinctly a regional problem, and as such concerns the state.

The same is true for cities which are employment centers of large metropolitan districts. This is so if only for the reason that the economic well-being of the state as a whole is intimately bound up with the economic well-being of its component municipalities. If, therefore, the municipalities "cannot do . . . whatever they need to have done . . . in their separate or individual capacities",[4] it is the legitimate object of the state government to assist them to do it.

An added forceful argument for removing traffic bottlenecks in areas of greatest congestion is currently being advanced by the medical profession. The constant frustration attendant upon driving on congested city streets; the heat, fumes, and noise, as well as the physical danger inherent in congestion—all these have a deleterious effect on the physical and mental health of the urban dweller.

Use of State Funds Justified

The question is bound to arise as to whether funds collected from motorists all over the state can justifiably be spent on local highway improvements. In answer reference is again made to the program of federal subsidy for local slum clearance and urban redevelopment activities. It is clear that many citizens living in slum-free communities also contribute to the program. Likewise, the Federal Aid Interregional Highway System is paid for by many citizens who seldom, if ever, use it. Since, apart from federal grants, state highway department funds come almost exclusively from motorists, and since traffic congestion is identified with the increased use of motor vehicles, the equitableness of using such funds for relief of congestion wherever found seems to be beyond controversy. Most of the motorists who

[4] . . . "the legitimate object of government is to do for a community of people whatever they need to have done but cannot do at all or cannot do as well for themselves in their separate or individual capacities."

—Abraham Lincoln

would contribute either come from the cities or make frequent use of their street systems. Furthermore, expenditure of state funds for urban highway improvements will in time permeate all major municipalities, whether such funds be appropriated on the basis of population, traffic volumes along given routes, or urgency of any specific project based on highway sufficiency ratings.

Nor is the principle any longer in question. In most states, state assistance to municipalities for highway construction is already available, but in most inadequate amounts. As mentioned above, state funds are currently being made available to local governments, usually in amounts directly related to the mileage of improved and unimproved roads in a municipality. These state funds are not very substantial. Furthermore, since they must be appropriated at every session of the state legislature, they cannot be used as a basis for long-range financing of large-scale improvements.[5] As a result, these funds are expended on minor improvements, sometimes totally unnecessary, and in any case of a character clearly susceptible to total action and within the ability to pay of most municipalities.

The various state highway departments also control and maintain certain streets in most municipalities. However, reference to the map of almost any municipality will demonstrate the lack of any sort of logic in such state-controlled street network. This is to be expected in view of the fact that the particular stretches of road under state jurisdiction were generally not selected on the basis of a logical study; rather, they are leftovers of a time when many streets were still outside city limits, ran through largely unimproved sections, or were main state highways, now supplanted by more modern alternate routes.

Having established in principle that a larger share of state funds should be expended within municipal boundaries, it would be well to question whether the present pattern of expenditure is necessarily the most effective one.

The major share of current state urban highway programs is de-

[5] A recent step toward the use of state-aid funds for long-range project financing was made in Michigan. As reported in the 1953 Municipal Year Book, Michigan adopted legislation permitting the issuance of municipal bonds in anticipation of future state-aid funds. The law was carefully drafted to insure that at least 60 percent of such funds would remain available for highway maintenance.

voted to providing express through-routes. On the state level this program is the counterpart of the Federal Highway Aid program (the principal concern of which is not to alleviate urban congestion, but to create a system of interregional highways) or is primarily concerned with construction of through toll and free roads. Thus the basic purpose of the state program is to relieve local streets of through-traffic by highways superimposed over the local street grid in a way to achieve minimum interference from local vehicular movement. This very concept (a minimum number of intersections achieved largely by locating the highway away from, or relatively inaccessible from, the area of greatest congestion) suggests that such highways contribute to the relief of, but cannot solve, the congestion prevalent along the central local street systems.

The cost of through-highways warrants their construction only in those cases where the volume of through-traffic is very large. Thus almost complete reliance on through-highways in urban areas precludes any appreciable state assistance to municipalities subjected to substantial amounts of through-traffic coming in from many different directions, but nowhere concentrated enough to justify the building of express highways. In many cases, however, it may be that this extra amount of through-traffic acts like the straw that broke the camel's back and causes the almost complete breakdown of an already overloaded street system.

The question therefore arises: Should general state revenues or special gasoline taxes, according to some formula, be used in aiding municipalities to improve a given primary network of local streets?

Urban Motorists Would Benefit

It is contended that the answer should be in the affirmative since improvement would benefit a number of motorists considerably larger than that served by throughways. To be sure, most of the benefitted motorists would be residents of urban or urbanized areas, but surely their class of citizenship is no different from that of the farmer or tradesman from village and town. Also, while there would, of course, be more interruptions with a consequent lesser rate of speed for through-traffic along local streets because of the larger number of

motorists using them, the aggregate saving in time would probably be greater than that saved by through roads.

Were state highway funds to be increasingly channeled into urban road improvements, it would not necessarily mean that the state's contribution to rural areas would diminish in the same amount. The current trend is toward more and more toll roads, financed out of direct user revenue. It would be entirely logical to extend the principle of toll charges even to portions of main state highways, the improvement of which is necessitated primarily by the volume of through-traffic. Motorists residing in adjoining municipalities could be issued stickers to place on their windshields exempting them from paying tolls.

This principle would apply particularly to highways which become inadequate only during a seasonal peak travel period (for which the responsibility lies generally with tourists, vacationers and week-enders). In these instances tolls might only be collected during the vacation months. This proposal may run afoul of the present rule prohibiting tolls on any highways benefiting from federal aid. Consideration might be given to amending this rule by a formula which would permit tolls on highways where the original cost of construction is fully amortized, or in some other similar way. In any case, however, it is believed there are ample instances of state highways, built and maintained exclusively with state funds, to which the principle would apply.

For the reasons outlined above it is believed that ample justification exists for an extension of state participation in local highway improvement programs. If granted, state highway aid to local governments should be made available in amounts related to the cost of specific, desirable projects, rather than be distributed yearly throughout the state in minute amounts. It is quite conceivable that if funds were made available, municipalities would agree to contribute a given share of the cost of any proposed improvement under some matching formula. It is not difficult to believe that their relative inaction up to the present time has been largely due to the fact that the magnitude of the task of modernizing their highway systems unaided has discouraged them from even tackling it.

However, urban highway improvement should be a cooperative

state-local program in more ways than just cost sharing. It is an established fact, for instance, that high building density is a primary cause of traffic congestion. It would be quite reasonable for the state to demand that any municipality seeking state highway aid write into its zoning ordinance provisions intended to reduce the total amount of floor area it would be possible to build in the more congested sections, to a reasonable multiple of the area of the lot. It is clear that, whether the funds be federal, state or local, their expenditure would be wasted if skyscrapers were to continue to replace low buildings, thus increasing the use of streets beyond any reasonably achievable capacity.

Equally, if in already built-up areas requirements for off-street loading facilities are not made retroactive, curb loading and unloading can effectively nullify the effect of millions of dollars spent on improvement of street layouts. Finally, if the municipality hesitates to provide adequate off-street parking lots permitting the effective prohibition of curb parking where necessary to insure a free traffic flow, there is little point in widening streets. It is therefore suggested that approval by the State Highway Department—which would certainly remain the most logical disbursing and supervisory agency —of any program of street improvements be made contingent upon its approval of a municipally conceived comprehensive plan, including (a) proposed zoning provisions as applied to traffic control; (b) proposed parking lot development programs, and (c) proposed traffic control regulations.

A program of this nature seems to be the only way urban highway improvement can be attempted on anywhere near the scale its traffic-carrying role demands. What is more, by enlisting the active participation of municipalities themselves to a degree not possible or realistically feasible in the present circumstances, a reasonably successful solution would be visible in a not too distant future.

Business Aids Traffic Problems

WILBUR S. SMITH
Technical Advisor, Eno Foundation

BUSINESS leaders face urban traffic problems head on. More than ever before, traffic difficulties in every American community have brought realistic interest and action from business groups. Why?

In a sense, traffic has backfired. Throughout history, businesses have developed along heavy routes of travel—through caravans of trade along the cross roads of commerce. Traffic and trade have made our cities. Foci of travel have become focal points of retail business. Many now speculate on how long and how far this will continue.

Personalized transportation afforded by the automobile produces so much congestion, delay, and irritation in cities, that significant changes are taking place in business locations and in basic patterns of city developments. Recent cordon counts show decreases in the number of persons entering the central business districts. Most changes are closely, if not directly, related to accessibility of the market areas in terms of the demands and desires of motorists and motor vehicle passengers. A dynamic cycle of city development is underway.

Public opinion polls frequently show that more citizens are concerned with traffic than with any other public problem. It is voted the Number One need. Significant action in traffic by public officials, or others, is acknowledged and credited in the surveys. Today the critical side of the problem has reached the importance of influence at the polling booths.

The rapid growth and current magnitudes of automotive transportation are well known. With registrations and travel at an all-time high, and continuing to grow at unprecedented rates, traffic congestion threatens some long and well established ways. To some business leaders and interests, growing traffic, registration, and congestion are accepted as a spur to business; others are becoming concerned; and some have promptly taken protective measures against

uncontrolled decentralization, increasing competition of outlying areas, changes in shopping habits, and changes in basic concepts of merchandising.

It should not be forgotten that to the average citizen there is nothing sacred about the downtown district, and that transportation forms cannot be dictated. Some businesses are now almost entirely dependent on automotive customers; others are largely dependent on various types of mass transit; many are anxious to increase the attractiveness of transportation facilities in the vicinity of their business. To this end, property owners, business executives, and developers are taking an active interest in traffic and transportation matters. They are bringing traffic professionals into the planning and operation activities of their own business.

Some cases and examples may serve to show how progress is being made, how business and urban problems are being improved.

Support for Traffic Improvements

Like many public improvements, traffic aids frequently bog down for lack of strong local leadership. It has long been customary to emphasize the seriousness of our traffic problems by accident rates. Leadership in accident-reduction campaigns was easily developed because of tolls in human lives and injuries. Now that urban traffic has grown to a point where serious congestion is a principal component of the total traffic picture, leadership and support for corrective action in this area are often difficult to develop. Admittedly there is a difference between the personal and group interests in safety, and those in movements. One involves personal losses and damages to the individual and user; the other involves appreciable losses to all economic activity and ultimately to the community. Leadership, essential to sustained, planned actions in the latter area, must obviously come largely from business and government.

In many cities, business groups have been reluctant or have refused to cooperate in traffic improvement programs. Frequently their concerted action is distinguished by opposing improvement in their traffic dilemma. Apparently they fail to recognize the seriousness of the problem, they aren't looking very far ahead, they are not

progressive, or they are die-hards ignorant of improved professional knowledge directly applicable to their problems. Fortunately, there is a note of change in such backward attitudes. Through their established organizations, business groups are beginning actively to support local traffic programs. They are urging early action by insisting that funds be provided and legislation passed that will make business areas accessible and attractive to potential trade.

Merchants' organizations, business associations, and individuals by a turn-about in their thinking can contribute a needed impulse to present efforts. Major urban re-development programs cannot succeed without business support. Extensive re-development underway in Pittsburgh and Baltimore are examples of what can be done.

Pertinent to this discussion are the traffic improvements (movement and parking) that form an integral part of any re-development. City newspapers led a business and public opinion survey to prove the importance of traffic improvements to the central business district. In some cities merchants have persistently demanded that something be done about parking. Committees of business leaders have aided in obtaining state assistance for new urban routes and expressways. By bringing proper groups together for discussion and conferences, disagreements and differences can be resolved, even though some compromise results.

Individual businesses and business organizations have sponsored employment of professional personnel in both an advisory and permanent basis, and have aided in providing funds to improve and supplement their professional training. Service on traffic and planning commissions permits proper evaluation of needs and actions; in some cases commercial or industrial firms have employed professional assistants whose services have been provided gratis to the city. Meetings of important business groups to discuss and plan ways and means for improving a traffic situation have frequently sparked a city-wide project.

Business leaders owe their concern with local traffic needs to the same degree and with the same ability they devote to business. To initiate a comprehensive traffic-improvement program most cities need an alert, determined business group to father the movement and sustain the necessary drive and determination.

Parking

For some years, merchants in many cities have taken an active part in traffic and parking. The problem is not new to them. In some cases they have stepped in with real action, particularly in the development of off-street parking. Some merchants have developed their own lots and garages to provide attractive parking for customers and thus maintain the growth of their established trade. Frequently this has been done because of similar action by competitors. Policies of large and well-known nation-wide department stores, as well as the larger chain food stores and other local retail groups, seem well established: they just don't build stores without parking provisions, though they are not always able to supply as much as is needed.

Large department stores are constructing garages to maintain business levels in downtown districts. Some of these have been described in detail in previous issues of the TRAFFIC QUARTERLY. Participation of business groups in parking programs of Oakland, Allentown, New Canaan and many other cities where equally effective steps have been taken, is widely known. In other cities, actions are so well known that they need not be reviewed. But they are significant because they are in sharp contrast to the attitude that responsibility for parking is the responsibility of public officials because "the businesses are the backbone of the community, and pay heavy taxes." One view means action, the other, procrastination—never done.

Buffalo Builds Four Garages

It is becoming increasingly apparent that solutions to parking problems of central business districts and established community areas can be effectively approached by the joint efforts of business leaders and public groups. Both can make important and necessary contributions. An example is the off-street parking program now underway in Buffalo. The city had a survey made to determine for garages. A Board of Parking was created to plan and direct these parking needs of the central business district and recommend sites

activities. Construction of three downtown garages, and one large outlying garage is now going forward.

The merchants formed a corporation which assumes responsibility for operating the garages on a non-profit basis, and guarantees financing. Simply, the city contributes: (1) technical study and direction; (2) powers of eminent domain to acquire sites; (3) low interest rates, since general obligation bonds are used for financing, and (4) abatement of taxes on land and structures, during the debt period.

The merchants acting as a body through a corporation agree to: (1) assume responsibility for operating garages without profit; (2) guarantee any financial losses incurred, and (3) encourage and support the city's over-all parking and traffic program.

In a dozen older outlying shopping centers of Buffalo, similar plans are being devised. In some of these, merchants may underwrite the cost of parking lots to provide free parking for customers. The entire program is moving ahead rapidly; both merchants and city officials are enthusiastic. This plan proves an effective way for business groups to participate actively in a city's parking program.

In Milwaukee a new parking association has been formed. It will attempt to develop additional parking expressly for shoppers and, by an interesting adjustment of rates, provide the greatest possible turnover in use of parking facilities.

In some cities merchants are supporting zoning amendments to require off-street parking and loading for new buildings and for major reconstruction of existing buildings. This is contrary to a prevalent attitude a few years ago, that such requirements could not be financially justified in a downtown area. They now realize that on a long range basis they stand to profit as much or more than most.

Off-Street Loading

The "right to the curb" for loading and unloading is no longer a byword of merchants. To expedite and improve deliveries and to remove congestion adjacent to stores, merchants and property owners are, at considerable expense, constructing off-street loading

facilities and improving receiving capacities. These actions demonstrate the difficulty of providing suitable conditions through curb regulations. The city and the police alone can rarely be effective in this traffic area.

In practically every city, organized merchant groups are seriously concerned with local parking needs. Whether the city has adopted a policy of developing public parking facilities, whether the needs are left entirely to private enterprise or a joint effort, merchants are increasingly and actively assisting in providing additional parking facilities. This trend is encouraging, even though some groups have become so involved in questions of policy and a reluctance to face needs as a *community* problem that little of a lasting and effective character is being accomplished.

Regulations

There are other encouraging developments. Business associations and business leaders are less obdurate and no longer as insistent on a status quo condition in traffic. The fear of *change,* even for a trial period, is disappearing. As a result, urban traffic is being improved by more one-way streets, by curb parking bans (especially during peak hours), by improved efficient transit operations, and by other traffic changes which in the past have been consistently opposed and blocked. The changes usually help business, and they should be planned with this as one important objective. When this is done, there is rarely an adverse effect on business interests.

Many cases are known of simple traffic improvement programs being opposed by merchants with unwarranted claims that they would be forced out of business. It is a rare case, however, in which business has actually suffered because of properly planned traffic regulations. Business *benefits* with increased traffic capacity. This is not to imply that regulation of traffic can never harm business. It is important to realize that traffic regulations should be proposed only after thorough technical study of automobile, truck, and pedestrian traffic, as well as of land uses and over-all roadway plans. The guesswork can be removed and results accurately anticipated by proper surveys and studies. Without such studies, merchants and other

interests have a right to protest. Their stakes are too high to take chances on crude hit-or-miss traffic treatments.

The willingness of merchants to look at problems from the standpoint of the public official, the planner, or the traffic engineer, and at least agree to a fair trial of some of the simple yet basic traffic regulations, can pay big dividends to both business and public groups. They would do well to be aware of their customers' traffic-wise likes and dislikes.

Objective Studies Have Value

Recognition of the need for sound approaches to traffic regulations suggests a discussion of some of the values of objective traffic studies.

Many people assume that all traffic control measures are the result of a thorough study. Since the early thirties "this type and that type" of survey has been made. People have been interviewed on the road and in their homes. Rubber tubes and light beams across the roadway constantly remind motorists that traffic data are being collected. Even photography and radar are now employed to study traffic. Yet with all this activity, much remains to be learned. In almost every city more factual information is needed to remove biases and unwarranted opinions. Sound programs for immediate and long-range correctives should be a continuing process.

To make programs factual and to encourage prompt action, business groups in some cities are contributing to the cost of necessary studies. This gives them a firsthand opportunity on an informal basis to participate in planning and discussion with an assurance that points of particular interest to them are properly investigated. This provides an incentive to cooperative action that reduces traffic programs and problems to a basis of mutual understanding and sincere joint approaches. Disagreements and opposing views are minimized. If there are to be oppositions, let them be factual. Delays are shortened.

It is one thing to make traffic studies, another to get something done as a result of them. All community interests should be represented and their leaders should make certain that survey reports are *used,* not shelved.

Some studies produce astonishing information. Some show that a large percentage of vehicles in the central business district have no desire to be there; that out-of-town shoppers are a substantial part of the total; that some residential areas do not contribute to business values in proportion to their purchasing power; that some forms of transportation are much more important than others; that curb parking contributes only a fraction of total parking needs, and many other conditions of special interest to business. In such studies, it must be kept in mind that local problems differ, with limited justification for widely applied general findings.

Mass Transportation

In spite of the trend toward, and desire of individuals for personalized transportation, it is recognized that a high percentage of those entering central business districts of most cities must be transported by transit. The larger the city, the greater the need for mass transportation. Physical limitations and economic laws dictate the need for a balanced program of urban transportation in which transit is a part. Merchants realize this, but few really know the actual extent to which their businesses are dependent on each form of travel. This can be readily measured and provides another opportunity for participation in surveys which will give essential data for objective planning.

Plans have been tried for merchant-transit cooperation in encouraging the use of mass transit by shoppers, validation plans providing free or reduced fare rides, joint development of fringe parking lots, special shoppers' buses, and guaranteed financial support for operations of certain bus routes. Information is not available to determine the extent to which such plans have succeeded. Unfortunately, in most instances they have been short-lived, but they show a recognized need for business-transit cooperation in properly integrating mass transportation with all forms of downtown travel.

A *quality* transit service is as important as a *quantity* service. This injects questions of economics into the over-all problem of basic needs; solutions thereby become complex. To provide desirable quality services in most cities, public officials and business interests

must cooperate with transit companies. Similarly with parking, the problem must be approached as a community problem requiring many joint and cooperative actions if needed services are to be obtained.

Traffic in Business

Traffic engineering is growing in importance in business development. This is especially true in planning new developments where traffic accessibility is a key consideration.

In some large retail business organizations, the "traffic report" is now considered as essential as the market analyst's report in any plans for new store development and for store expansions. Business realizes that no matter how great the market potentials, they cannot be tapped and fully exploited without easy access. They know, too, that convenient parking and service facilities are necessary.

Questions of street capacity, route improvements, traffic growth, time and physical separations of retail and other traffic peaks, parking automotive services, and similar transportation factors become part of the complete plan for a new shopping center, or any important business development. The market analysts increasingly apply traffic values to population distributions, purchasing power, and other market factors to devise buying potentials.

The large shopping center exemplifies opportunities for traffic approach to retail problems. Many shopping centers will provide from 5,000 to 10,000 parking stalls. For successful operation these stalls must be used. It is apparent that high traffic volumes are anticipated when the number of spaces at the center may equal the number of parking spaces in the central business district of cities of from 100,000 to 200,000 population.

Adequate roadway capacity, and attractive internal circulation with parking are equally important in other retail developments. Sometimes business expansion is impossible because of traffic and parking limitations. Often a business development is dependent upon alterations in, or additions to, the public road system.

Developers, architects and major tenants are asking for studies on planning ingress and egress facilities, to develop attractive and safe internal circulation, and to lay out parking areas. They want to

be careful not to produce traffic problems similar to those which brought about, in many cases, the need for the new retail outlets. In this connection it might be noted that traffic studies have resulted in abandonment of plans for shopping centers when it can be demonstrated that there is insufficient road capacity to accommodate additional traffic the center will generate.

Frustrations in cities are closely associated with traffic and parking problems. Many agencies are interested and involved. Merchants and other business groups can play a key role in solutions. There are many signs that traffic is becoming an important interest of these groups. This is encouraging and healthy.

A Tale of Sixty-two Cities

MAYNARD A. BEBEE

Mr. Bebee is a principal civil engineer with the Bureau of Highway Planning, New York State Department of Public Works. He is in charge of the Urban Planning Unit which is responsible for the Arterial Route Reports for New York State cities. He has twenty-eight years of experience with the department in nearly all branches of highway design, in traffic control and traffic planning, first in the Buffalo area, and now at the main office in Albany. He holds a professional engineer's license and is a member of the Institute of Traffic Engineers.

ONE of these cities, incorporated in 1916, had a population of 2236 in 1950. It is Sherrill, New York, in Oneida County, where silverware is manufactured. Another is the great metropolis of New York City with a population of 7,891,957, one-twentieth of the people in the United States.

For Sherrill, no arterial highway plans are under consideration. It falls in the same category as the sixty-three other smaller urban areas in the state. With respect to the City of New York, arterial plans have long been under intense study, and an arterial route system was established several years ago, as mutually agreed upon by the city, the state, and the federal government. The other sixty cities are a principal concern of the New York State Department of Public Works which now is developing arterial route plans for each of them.

The Department was made responsible for this arterial planning in 1944 when legislative action added 584 miles of urban routes to the state highway system. The first urban traffic survey was conducted early in 1946 in Buffalo; the others followed soon after. By the end of 1948, surveys had been completed in fifty-nine cities and eleven reports had been presented for city action and approval. In recognition of the home-rule principle, each of the cities is a responsible partner in its arterial route development. It must first approve the plan or assist in developing mutually acceptable modi-

fications and then assume one-half the right-of-way costs, after the general plan is approved, in the amounts required for the projects as they are undertaken. Details of the plan also require city approval before the contracts are let.

Forty reports have been presented, thirty plans agreed upon, the majority of them incorporated in the highway law. So this phase of arterial planning is nearing completion. The attached tabulation shows the status of the planning, city approvals, legislative action, construction, and other items of general interest.

When the plans enter the construction stage, design details, minor revisions, re-checks of traffic volumes and trends, and various other factors enter the picture. These require constant attention to each live arterial plan. As additional plans are approved, this specialized study increases. Completion of the report phase of the planning program, together with more adequate highway financing, which is soon expected in New York State, will alter and increase the urban planning work both in the Bureau of Highway Planning at Albany, and in each of the ten district offices.

A review of the arterial route plans shows the variety of route arrangements and types that must be fitted to each city. Certain basic layouts seem related to population groups. The plans for larger cities generally have outer and inner loops, with radial or grid route patterns connecting the loops. One or more high-type principal routes and major street systems are appropriate for many of the smaller cities. Minor cities that are shopping and industrial centers for only the surrounding areas are often adequately served by improvements on major streets.

In the forty cities where reports have been completed, the total mileages and percentages by types are as follows:

Types	*Miles*	*Per Cent*
MAJOR STREETS		
Undivided	200	54
Divided	72	19
Totals	272	73

BUREAU OF HIGHWAY
STATUS OF URBAN ARTERIAL
AUGUST 31, 1953

City	Population 1950 Census[1]	Arterial Law 1944	Arterial Report			Revised Status	
			Estimate Primary Plan[2]	Primary Plan	Supplementary Plan	Primary Plan	Estimate Primary Plan 1952 Prices[3]
Albany	134,995	18.2	$ 16,768,000*	8.8	6.3	8.8	$ 22,658,000
Amsterdam	32,240	3.2				6.0	2,550,000
Auburn	36,772	6.4				6.4	2,100,000
Batavia	17,799	6.2	1,614,000	5.60	2.3	5.6	2,130,000
Beacon	14,012	2.5				2.5	920,000
Binghamton	80,674	11.2	9,657,010	11.15		11.2	15,000,000
Buffalo	580,132	47.6	23,545,000*	21.2	15.0	21.2	57,700,000
Canandaigua	8,332	4.4	1,550,000	5.8	2.7	5.8	2,460,000
Cohoes	21,272	1.8				1.8	570,000
Corning	17,684	3.0	7,627,000	2.6	1.7	2.6	3,820,000
Cortland	18,152	4.6	1,549,000	3.2	1.2	3.2	2,174,000
Dunkirk	18,007	3.1	1,017,000	4.7	0.8	4.7	2,300,000
Elmira	49,716	9.2	4,642,000*	8.0	4.1	8.0	5,778,000
Fulton	13,922	5.2	1,717,000	5.7		5.7	2,160,000
Geneva	17,144	2.4	2,628,000	5.15		5.2	4,050,000
Glen Cove	15,130					2.4	1,120,000
Glens Falls	19,610	2.9	376,500	3.7		3.7	376,500
Gloversville	23,634	3.3	2,095,400	7.0		2.0	340,000
Hornell	15,049	2.7	2,468,800	2.1	0.5	2.1	3,770,000
Hudson	11,629	2.9				2.9	1,020,000
Ithaca	29,257	5.0	2,010,000	3.13	3.87	3.1	2,850,000
Jamestown	43,354	9.4	2,753,250	9.2	0.7	9.3	3,660,000
Johnstown	10,923	3.4	1,329,200	4.8		4.8	1,743,000
Kingston	28,817	5.4				5.4	2,550,000
Lackawanna	27,658	4.0	2,452,000	5.2		5.2	3,310,000
Little Falls	9,541	1.7				3.6	2,100,000
Lockport	25,133	4.6	2,490,000	6.0	1.0	6.0	3,160,000
Long Beach	15,586					3.3	1,150,000
Mechanicville	7,385	1.7	1,897,000	1.94		1.9	2,560,000
Middletown	22,586	2.3				2.3	780,000
Mount Vernon	71,899	3.1				5.0	3,750,000
Newburgh	31,956	3.9				3.9	2,080,000
New Rochelle	59,725	2.3	9,238,000*	8.22	2.1	8.2	11,440,000
Niagara Falls	90,872	14.1				14.1	8,440,000
North Tonawanda	24,731	4.4	1,853,000	6.00	4.2	6.0	2,410,000
Norwich	8,816	1.7				2.6	960,000
Ogdensburg	16,166	5.5				6.3	3,880,000
Olean	22,884	6.3	2,650,000	7.4		7.4	3,280,000
Oneida	11,325	2.0	2,685,200	4.5		4.5	3,130,000
Oneonta	13,564	2.9	1,963,500	3.9		3.9	2,690,000
Oswego	22,647	6.0	2,198,500	8.3		8.3	2,570,000
Peekskill	17,731	4.4				4.4	1,650,000
Plattsburg	17,738	4.1	2,766,200	6.5		7.8	3,583,000
Port Jervis	9,372	4.3				4.3	1,980,000
Poughkeepsie	41,023	4.3	6,744,300	4.07		4.1	9,600,000
Rensselaer	10,856	1.4	1,000,000	0.9		0.9	1,460,000
Rochester	332,488	35.1	34,159,700	28.80	7.0	28.8	49,710,000
Rome	41,682	3.5	2,255,000	5.4	1.6	5.4	3,360,000
Rye	11,721	3.3				3.3	2,450,000
Salamanca	8,861	5.1	2,842,000	6.4	1.1	7.5	3,300,000
Saratoga Springs	15,473	5.0	1,922,000	5.6		5.6	2,350,000
Schenectady	91,785	8.9	5,445,000*	4.21	2.8	4.2	7,800,000
Syracuse	220,583	16.1	23,479,000*	20.86	0.7	19.9	33,900,000
Tonawanda	14,617	3.4	2,327,000	2.79	1.5	2.8	3,130,000
Troy	72,311	16.6				8.3	11,000,000
Utica	101,531	12.2	11,353,600*	16.8		16.8	15,500,000
Watertown	34,350	9.5	6,180,100	11.84		11.8	8,800,000

HWAY PLANNING
ERIAL ROUTE PROGRAM

31, 1953

s mate ry Plan Prices[a]	Arterial Law 1953[b]	O & D Survey	Report Presented to City	Date of City Approval	Projects under Construction or Completed			Projects Completed
					Number Projects	Miles[a]	Contract Cost[c,r]	
658,000	8.8	1947	3-21-50	2-5-51	2	0.39	$ 186,454[r]	1
550,000	3.2	1947						
100,000	6.4	1948						
130,000	7.9	1946	7-22-48	9-7-48	4	2.47	1,355,848	3
920,000	2.5	1947						
000,000	11.15	1946	12-19-47	1-5-48	5	5.11	3,001,756	4
700,000	35.5	1946	6-6-46	11-6-46	11	4.00	13,751,529	6
460,000	8.13	1946	10-28-48	11-1-48	2	1.79	821,142	2
570,000	1.8	1947						
820,000	4.99	1946	11-18-47	11-26-47	5	0.60	917,238[a,r]	5
174,000	4.6	1946	9-30-49		1	0.42	179,405	1
300,000	3.1	1946	1-23-47	2-18-47	2	2.61	768,376	2
778,000	10.1	1947	12-13-51	12-30-52	3	1.49	542,732[a]	2
160,000	5.7	1948	5-17-51	2-29-52				
050,000	5.1	1947	8-27-48	9-16-48	3	1.87	2,433,655	2
120,000		1947						
376,500	2.9	1947	6-25-52					
340,000	2.0	1946	9-29-49	2-6-51				
770,000	2.7	1946	11-23-48					
020,000	2.9	1947						
850,000	7.5	1946	3-7-49	4-6-49				
660,000	9.3	1947	7-6-50	12-3-51				
743,000	4.8	1946	9-29-49	12-5-49	2	3.89	1,014,309	
550,000	5.4	1947						
310,000	4.0	1947	2-3-49	3-7-49	3	1.69	884,871[r]	3
100,000	1.7	1948						
160,000	5.95	1947	2-2-50	2-28-50	1	0.51	284,224	
150,000	3.0	1947						
560,000	1.9	1946	7-12-49	7-29-49	1	0.69	313,361	1
780,000	2.3	1947						
750,000	3.1	1947						
080,000	3.9	1947			1	0.14	237,755[b]	1
440,000	8.6	1946	6-24-49	11-10-49				
440,000	14.1	1949						
410,000	6.0	1948	5-26-49	7-5-49				
960,000	1.7	1947	3-27-53	4-28-53				
880,000	5.5	1948						
280,000	7.4	1948	5-3-51	11-25-52				
130,000	2.0	1948	1-10-52					
690,000	2.9	1947	5-24-51					
570,000	8.3	1947	4-26-51	5-8-51	1	1.08	434,056	
650,000	4.4	1947			2	0.07	66,575[a]	2
583,000	7.8	1947	9-27-51	2-2-53				
980,000	4.3	1947						
600,000	4.2	1946	12-12-47	7-21-52				
460,000	1.4	1947	3-21-50					
710,000	33.51	1946	9-17-47	11-9-48	11	7.93	10,132,705[a]	5
360,000	5.5	1946	9-19-47	3-1-48	3	3.47	1,765,522	2
450,000	3.3	1947						
300,000	7.5	1948	12-5-51	12-11-51				
350,000	5.6	1947	4-17-52	7-2-52				
800,000	6.1	1946	5-18-48	6-14-48	1	0.20	93,400	
900,000	21.0	1946	9-18-47	2-24-48	2	2.05	531,210[a]	2
130,000	2.79	1948	5-26-49	6-27-49				
000,000	16.6	1947						
500,000	16.8	1947	11-21-50	1-16-52	1	1.18	518,071	
800,000	9.5	1946	3-8-49	5-23-49	2	2.26	1,616,411[r]	

Dunkirk	18,007	3.1	1,017,000	4.7	0.8	4.7	2,300,000
Elmira	49,716	9.2	4,642,000*	8.0	4.1	8.0	5,778,000
Fulton	13,922	5.2	1,717,000	5.7		5.7	2,160,000
Geneva	17,144	2.4	2,628,000	5.15		5.2	4,050,000
Glen Cove	15,130					2.4	1,120,000
Glens Falls	19,610	2.9	376,500	3.7		3.7	376,500
Gloversville	23,634	3.3	2,095,400	7.0		2.0	340,000
Hornell	15,049	2.7	2,468,800	2.1	0.5	2.1	3,770,000
Hudson	11,629	2.9				2.9	1,020,000
Ithaca	29,257	5.0	2,010,000	3.13	3.87	3.1	2,850,000
Jamestown	43,354	9.4	2,753,250	9.2	0.7	9.3	3,660,000
Johnstown	10,923	3.4	1,329,200	4.8		4.8	1,743,000
Kingston	28,817	5.4				5.4	2,550,000
Lackawanna	27,658	4.0	2,452,000	5.2		5.2	3,310,000
Little Falls	9,541	1.7				3.6	2,100,000
Lockport	25,133	4.6	2,490,000	6.0	1.0	6.0	3,160,000
Long Beach	15,586					3.3	1,150,000
Mechanicville	7,385	1.7	1,897,000	1.94		1.9	2,560,000
Middletown	22,586	2.3				2.3	780,000
Mount Vernon	71,899	3.1				5.0	3,750,000
Newburgh	31,956	3.9				3.9	2,080,000
New Rochelle	59,725	2.3	9,238,000*	8.22	2.1	8.2	11,440,000
Niagara Falls	90,872	14.1				14.1	8,440,000
North Tonawanda	24,731	4.4	1,853,000	6.00	4.2	6.0	2,410,000
Norwich	8,816	1.7				2.6	960,000
Ogdensburg	16,166	5.5				6.3	3,880,000
Olean	22,884	6.3	2,650,000	7.4		7.4	3,280,000
Oneida	11,325	2.0	2,685,200	4.5		4.5	3,130,000
Oneonta	13,564	2.9	1,963,500	3.9		3.9	2,690,000
Oswego	22,647	6.0	2,198,500	8.3		8.3	2,570,000
Peekskill	17,731	4.4				4.4	1,650,000
Plattsburg	17,738	4.1	2,766,200	6.5		7.8	3,583,000
Port Jervis	9,372	4.3				4.3	1,980,000
Poughkeepsie	41,023	4.3	6,744,300	4.07		4.1	9,600,000
Rensselaer	10,856	1.4	1,000,000	0.9		0.9	1,460,000
Rochester	332,488	35.1	34,159,700	28.80	7.0	28.8	49,710,000
Rome	41,682	3.5	2,255,000	5.4	1.6	5.4	3,360,000
Rye	11,721	3.3				3.3	2,450,000
Salamanca	8,861	5.1	2,842,000	6.4	1.1	7.5	3,300,000
Saratoga Springs	15,473	5.0	1,922,000	5.6		5.6	2,350,000
Schenectady	91,785	8.9	5,445,000*	4.21	2.8	4.2	7,800,000
Syracuse	220,583	16.1	23,479,000*	20.86	0.7	19.9	33,900,000
Tonawanda	14,617	3.4	2,327,000	2.79	1.5	2.8	3,130,000
Troy	72,311	16.6				8.3	11,000,000
Utica	101,531	12.2	11,353,600*	16.8		16.8	15,500,000
Watertown	34,350	9.5	6,180,100	11.84		11.8	8,800,000
Watervliet	15,197	3.3				2.9	1,700,000
White Plains	43,466	2.1	7,106,000	8.2		8.2	8,310,000
Yonkers	152,798	11.0				17.4	26,900,000
Total—Upstate Cities	2,994,362	384.1	$218,354,260	285.61	61.17	391.30	$397,972,500
New York City	7,891,957	195.04					
Total—New York State	14,830,192	579.14					

NOTES

[a] Article XII, Paragraph 340, Route 4. (Pg. 229, Highway Law of 1949)
[b] Article XII, Paragraph 341–34. (Pg. 290, Highway Law of 1949)
[c] Article XII, Paragraph 341–57. (Pg. 306, Highway Law of 1949)
[d] Includes one project, cost of $10,107, paid from Canal Funds.
[e] Includes one project, cost of $12,938, paid 100% from Federal Funds.
[f] Does not include the following Public Service Commission Grade Crossing Elimination Projects related to Arterial Plans:

Corning: 8.20 miles, cost of $7,805,799
Kingston: 0.19 miles, cost of $ 917,126
Watertown: 0.23 miles, cost of $ 394,253

00,000	3.1	1946	1–23–47	2–18–47	2	2.01	705,570	1
78,000	10.1	1947	12–13–51	12–30–52	3	1.49	542,732[a]	2
60,000	5.7	1948	5–17–51	2–29–52				
50,000	5.1	1947	8–27–48	9–16–48	3	1.87	2,433,655	2
20,000		1947						
76,500	2.9	1947	6–25–52					
40,000	2.0	1946	9–29–49	2–6–51				
70,000	2.7	1946	11–23–48					
20,000	2.9	1947						
50,000	7.5	1946	3–7–49	4–6–49				
60,000	9.3	1947	7–6–50	12–3–51				
43,000	4.8	1946	9–29–49	12–5–49	2	3.89	1,014,309	
50,000	5.4	1947						
10,000	4.0	1947	2–3–49	3–7–49	3	1.69	884,871[f]	3
00,000	1.7	1948						
60,000	5.95	1947	2–2–50	2–28–50	1	0.51	284,224	
50,000	3.0	1947						
60,000	1.9	1946	7–12–49	7–29–49	1	0.69	313,361	1
80,000	2.3	1947						
50,000	3.1	1947						
80,000	3.9	1947			1	0.14	237,755[b]	1
40,000	8.6	1946	6–24–49	11–10–49				
40,000	14.1	1949						
10,000	6.0	1948	5–26–49	7–5–49				
60,000	1.7	1947	3–27–53	4–28–53				
80,000	5.5	1948						
280,000	7.4	1948	5–3–51	11–25–52				
30,000	2.0	1948	1–10–52					
90,000	2.9	1947	5–24–51					
70,000	8.3	1947	4–26–51	5–8–51	1	1.08	434,056	
50,000	4.4	1947			2	0.07	66,575[b]	2
83,000	7.8	1947	9–27–51	2–2–53				
80,000	4.3	1947						
600,000	4.2	1946	12–12–47	7–21–52				
460,000	1.4	1947	3–21–50					
710,000	33.51	1946	9–17–47	11–9–48	11	7.93	10,132,705[d]	5
360,000	5.5	1946	9–19–47	3–1–48	3	3.47	1,765,522	2
450,000	3.3	1947						
300,000	7.5	1948	12–5–51	12–11–51				
350,000	5.6	1947	4–17–52	7–2–52				
300,000	6.1	1946	5–18–48	6–14–48	1	0.20	93,400	
900,000	21.0	1946	9–18–47	2–24–48	2	2.05	531,210[b]	2
130,000	2.79	1948	5–26–49	6–27–49				
000,000	16.6	1947						
500,000	16.8	1947	11–21–50	1–16–52	1	1.18	518,071	
800,000	9.5	1946	3–8–49	5–23–49	2	2.26	1,616,411[f]	
700,000	3.3	1947						
310,000	2.1	1947	5–10–51					
900,000	11.0	1946						
972,500	405.52		40	33	69 23 Cities	45.91	$ 41,850,603[e g]	44 17 Cities
	195.04					21.01	$116,980,525	
	600.56							

[a] Does not include: Cost of Thruways and Thruway Spurs inside cities.
Cost of State Highway Connections outside cities.

[1] 1950 Census allocated college students to location of schools rather than to location of home residence.

[2] Construction and rights-of-way costs as shown in each Report.

[3] Miles of miscellaneous and other work excluded. Report revised from 1951 to include center line mileage only.

[4] Contract cost does not include engineering, land acquisition, etc.

[5] Mileage shown includes revisions up to and including date.

[6] Includes estimated costs for pending reports.

[7] Includes Federal and/or State Funds spent within city limits.

Types	*Miles*	*Per Cent*
EXPRESSWAYS		
Expressways	20	6
Freeways	49	13
Totals	69	19
THRUWAYS AND PARKWAYS		
	31	8
TOTALS	372	100

The arterial highways, as defined by New York State law, are entirely within the city's limits. However, plans developed in the urban area reports include modernized connections with the suburban and rural state highway network, and the great New York State Thruway.

The portion of the Thruway from Buffalo to Suffern, near the New Jersey state line, is scheduled for completion late in 1954. The Thruway bridge and connection into New York City will be completed in time for the 1955 mid-summer traffic.

As an added starter to the highway planning task there is in progress a state-wide study and revision of the urban areas including the sixty-three other New York State places with more than 5000 people. These will be included, in many instances, with one or more cities and other populated sites to form a total of some fifty over-all urban areas for the state.

They will include the Niagara Frontier, Capitol District, and New York Metropolitan areas, as well as smaller individual areas. The establishment of urban highway systems including long-range plans for each of these areas will provide the blueprints for New York State's urban program, and will solve many of the major traffic problems in the State's sixty-two cities.

Parking in Washington, D. C.

CHARLES M. UPHAM

Mr. Upham, a consulting engineer in Washington, D. C., is currently directing a survey and design for a highway system in Egypt, a commission similar to the one he performed for the Republic of Mexico. He served as consulting engineer for the Pennsylvania Turnpike Commission, for the Compania de Cubana de Contratistas, Havana, and for the Maryland State Road Commission. For twenty-five years, he served as Engineer-Director of the American Road Builders' Association in Washington; was the United States delegate to the Permanent International Road Congress at The Hague in 1938, and in 1946 received the Bartlett Award for distinguished service in highway engineering. He is vice president of the Eno Foundation for Highway Traffic Control. Mr. Upham has served as chief engineer for the North Carolina State Highway Commission and the Delaware State Highway Commission, and as resident engineer for the Massachusetts State Highway Commission. He has served also as chairman of the Highway Committee of the Washington, D. C., Board of Trade, as director of the Highway Research Board of the National Research Council, and in 1942 he assisted in organizing ordnance companies for the Army of the United States.

THE parking problem in the Nation's Capital was recognized as early as 1925 when a forum was held by citizens, business interests and government representatives to discuss ways and means of coping with it. As a result of this meeting, a study of transportation was made to gather facts upon which to base future plans concerning traffic and terminal parking facilities.

At that time the population of the District of Columbia was a little over 400,000, and automobile registrations were about 115,000. In order to get a true picture of the traffic congestion today, it is necessary to take into consideration the phenomenal growth in the suburbs of Washington which actually lie in Maryland and Virginia, and are known as the "Metropolitan Area." The population in this area is now over one and one-half million.

The findings in the 1925 study, while not followed up with

organized effort, serve as a basis to show the very significant change that has taken place in transportation habits. In 1925, over 57 percent of our people used local and interurban mass transportation in everyday life—20 percent used automobiles and 23 percent walked to work, or to shop. Today 40 percent of our workers and over 30 percent of the business and shopping trips use private vehicles. Almost no one walks or rides a bicycle to work or to shop.

The real brunt of the parking problem is in the central business district, covering an area of 1.5 square miles, which receives and discharges a volume of approximately 425,000 automobiles, excluding taxis and commercial vehicles, on average weekdays from 7 A.M. to 6 P.M.

Congress Takes a Hand

In 1942 traffic congestion had become so great that Congress declared that the free circulation of traffic of all kinds through the highways of the District was necessary to the health, safety and general welfare of the public; and at the same time enacted legislation creating the Motor Vehicle Parking Agency of the District of Columbia—and authorizing the Commissioners of the District of Columbia to acquire, operate and regulate public off-street parking facilities.

Later Congress enacted legislation which required funds derived from parking meters to be placed in a special fund for the eventual purchase of off-street parking facilities to be operated and managed by private enterprise. (Approximately $1,000,000 is now accumulated and on hand.)

The Motor Vehicle Parking Agency originally consisted of seven members (recently increased to ten)—three from designated government departments and four others selected by the District Commissioners. The functions of the Agency are to make surveys, studies, reports and recommendations to the Commissioners regarding off-street parking.

Curb parking, meters and other traffic matters are handled by the Department of Motor Vehicles and Traffic.

It should be pointed out that the city government of Washington is administered by three commissioners appointed by the President of the United States. While these commissioners have broad au-

thority, the financing of all projects and activities is by authorization from Congress. Therefore, any off-street parking project which requires financing must be submitted to Congress for approval.

The Motor Vehicle Parking Agency has had the cooperation of many groups in its efforts to solve the off-street parking problem. Surveys and reports have been made by several civic groups as well as by engineering firms. The findings of these groups generally coincide. All of them point to the tremendous concentration of traffic in an area approximately one-eightieth of the size of the entire District of Columbia.

30,000 Spaces for 170,000 Cars

It is estimated that every day some 141,000 vehicles come into this area for the purpose of parking from twenty minutes to all day. With fewer than 30,000 car spaces at the curb and off-street, this downtown area can be said to have a maximum daytime turnover of 90,000 vehicles. Most surveys reveal an average turnover of 2.4 vehicles in an 8-hour day; however, the Washington studies and the 425, 000 vehicles that the cordon count records show cover a 10-hour period.

In five surveys ,which included three cities of 250,000 to 500,000 population and two cities of a size comparable to Washington, the findings showed that 60 percent of the vehicles checked in cordon counts pass on through and do not park in the central business district. Thus in Washington, 40 percent of 425,000 vehicles, or 170,000 vehicles daily, have a potential desire to park. Since the existing 30,000 car spaces, on and off-street, at maximum capacity downtown in Washington could conceivably turn over three times per day, and accommodate 90,000 vehicles in ten hours, the remainder is 80,000 vehicles in circulation downtown, unable to find parking space. This can be said to be an estimate of a deficiency which approximately 25,000 added off-street car spaces would accommodate and erase.

Among the recommendations made to the District of Columbia Commissioners by the Parking Agency are:

> Underground garages beneath several federal parks and other government properties.

Demolition of a District-owned building and construction of a combined super-market with underground parking and upper floor levels of parking. (A special Act of Congress would be required for such a project.)

The appropriation of $20,000,000 special revolving trust fund through an Act of Congress. This trust would serve the useful purpose of acquiring several strategically located downtown sites for off-street parking facilities.

The Agency has indicated, however, that before any of these recommendations is adopted, private enterprise should be given the opportunity to provide the necessary off-street parking facilities.

Merchants Provide Off-Street Parking

In the last few years, notable progress has been made along this line. Several merchants have provided excellent parking facilities for their customers. And it is felt there is also a field for cooperative action by groups of merchants who could get together, subscribe capital to a joint enterprise, and build one or more parking garages strategically located with respect to their stores. Such a group could readily find the needed capital and it need not count on a greater direct money return than would cover operation, depreciation and carrying charges, finding its profit in increased sales. Thus it could afford to give substantial discounts, or even free parking, for customers by validation arrangements. Such joint enterprise has been successfully carried out in several cities.

A new trend in off-street parking has been established in connection with office buildings. In 1950 a new office building was opened with a ramp-type parking garage in the center core of the building. This provides park-at-your-desk service for occupants of the building, as well as space for visitor-parking in the same building. Ramps are spiral and wide enough to allow two-way traffic. Approximately 400 car spaces are provided on twenty-seven levels, in an eleven-story structure.

In 1951 an automatic elevator-type parking garage was constructed in Washington. This garage was a radical change from the

ramp-type and has proved very successful. One man operates the 72-car capacity facility of eighteen levels on a ground space of 24 x 62 feet in high-cost business property. Two elevators with automatic positioners deposit a car forward or backward and the device also retrieves a vehicle from its parking space to the ground floor receiving dock.

Two large office buildings under construction at this time will each have a spiral ramp-type parking garage in three basement floors for the convenience of the occupants and visitors to these office buildings.

The principal operators of parking lots and facilities in Washington are members of the Washington Parking Association and this group, with the encouragement and cooperation of the Motor Vehicle Parking Agency, is opening up new facilities rapidly. In one instance this group was prepared to erect a very large parking facility on government property. The project was blocked, at least temporarily, because under present law this property could be leased for not more than two years, whereas in order to justify the large investment to build the structure a 50-year lease would be required. An Act of Congress is necessary to extend the lease period to enable this project to proceed.

In the meantime, the parking operators are moving as fast as it is feasible, to establish additional parking spaces.

The possibility of fringe parking lots has been explored, but because of the high cost of land, which would affect the parking rate, plus transportation costs to and from the central business district, such an arrangement seems impractical. However, this matter is still receiving attention.

At the present time there are 8,043 spaces under construction, proposed for a year hence, or in the drawing board stage, as follows:

1,660 car spaces at five different sites, under construction
1,883 car spaces at seven different sites, proposed—year hence
4,500 car spaces at seven different sites, drawing board stage

The Parking Agency staff studies for January through August, 1953 report an amazing record of downtown parking spaces. Five major building projects to be ready for public use about July 1, 1954, will

supply about 1500 car spaces; parking lot additions in the downtown area should add 500 more, making a grand total addition of 2,000 car spaces accomplished by Agency encouragement of private enterprise. This record of added car spaces, compared with a total gain of 2,105 from 1941 through 1952 in the downtown core, is encouraging.

The trend of the inpouring vehicle traffic into the central buiness district has shown no indication of leveling off—on the other hand it has shown a steady and continuous increase. However, if the momentum of providing off-street parking by private enterprise continues as it has in 1953, it should be able to cope with the situation.

The Virginia State Police and Problems of Traffic Policing

COLONEL C. W. WOODSON, JR.

Colonel Woodson became a trooper of the Virginia State Police in July, 1932, and has held the ranks of sergeant, lieutenant, captain, major and colonel. In 1940, he was appointed Executive Officer of the State Police and in 1942 Governor Darden appointed him Superintendent. When the Governor's Highway Safety Committee was named in 1946, Colonel Woodson was a member and now holds the position of executive chairman. He is a past president of the Virginia Association of Chiefs of Police; was president of his class (1940) at the F. B. I. National Academy; is chairman of the Police Division of the National Safety Council; member of the executive committee, Traffic Section, National Safety Council; chairman of the Civil Defense Advisory Committee, International Association of Chiefs of Police, and a member of the executive committee of the same organization. Colonel Woodson is a vice president of the International Association of Chiefs of Police.

SIR WILLIAM GILBERT'S line, "A policeman's lot is not a happy one," may not be true to the letter but modern traffic with its millions of otherwise law-abiding "violators" has presented a novel challenge to the police profession.

Today's state trooper—or his counterpart—has come a long way from the old "billy and badge" officer of a half-century ago. This has been occasioned less by scientific aids to police—and to crime—than by the growth of motor vehicle traffic and its killers, maimers, and destroyers who do not consider themselves lawbreakers in the full sense of the word.

Formerly, the relatively small part of our people who were criminals were largely limited to criminal types. Now, both sexes, all ages, races, creeds, temperaments, and stations of life use automobiles and break traffic laws. The traffic police officer faces lawbreaking *en masse* by persons with no previous arrests who are not convinced they have committed offenses worthy of arrest. The

general public does not consider improper driving, with its wake of death, anti-social behavior; both juror and witness are loath to give traffic cases the attention they merit. Therein we have a main stumbling block to proper traffic enforcement.

In addition to high professional and physical qualifications, today's officer must be emotionally stable, courageous, personable, polite, understanding and reasonable, but he must be inflexible when unpleasant duty arises. He must efficiently extract an elderly lady from a snarl of traffic into which she has projected herself, effectively handle a belligerent drunken driver or control a teenager mad with speed. He must be prepared when a gun is thrust into his face by an escaping convict or other criminal who has taken to the automobile to expedite the commission of his acts.

Today's trooper must be a specialist in many fields germane to traffic-law enforcement and have a working knowledge of others. He must realize that, in the eyes of the public he serves, *he* is the department and all for which it stands. He has to resign himself to the hard fact that he can no longer live a normal life according to civilian standards for fear of public criticism, although he may break no law. He must be above corruption. In turn, the state should pay sufficient salary, augmented by allowances and uniforms, to maintain a fitting standard of living. The state should also provide job security, proper equipment to perform his duties, freedom from arbitrary transferrals, demotions, and dismissals, and an organization of which he can be proud.

Virginia's Standards for Recruits

In the prospective recruit, we demand high physical standards, a complete high school education and willingness to serve anywhere in Virginia before we turn attention to the individual man. If he can successfully meet these standards, he takes adaption and general ability tests and, if he passes these, he is subject to searching character investigation that ends in a personal interview. It has been our policy to operate understaffed rather than to accept men below our standards.

When he comes through with flying colors, he remains in a pro-

bationary status, although he is placed at once on the payroll at full salary with time accruing for periodic merit increases. The probationer is assigned at once to a duty station where he works as an observer with an experienced trooper until enough men are recruited to justify a basic training session.

While the prospective trooper receives field training and a convenient introduction to police work, there is another and good reason for this procedure. Virginia has a substantial investment in a trained man and does not want to lose it. Some apparently qualified men prove during their probationary period that they simply are not suited for police work or that they are not always amenable to the necessary discipline. Others discover they have neither liking nor aptitude for the practical side of the work. Thus the state is spared the expense of advanced training, and the opening in the training school is available to a more suitable prospect.

Basic Training Methods

Our basic training consists of twelve weeks of work and discipline at our recently completed $300,000 school, situated in conjunction with our headquarters, near Richmond. The building contains a classroom, laboratory, recreation area, sleeping and dining facilities, and offices and quarters for supervisory personnel. Adjoining is the departmental firearms range.

Here the probationer studies accident investigation, chemical tests for intoxication, criminal law, fingerprinting, first aid, traffic control, interrogation of witnesses, evidence and photography. He is also taught typing for clearness in his official reports, public speaking, and the meaning of public relations. Naturally he is brought to a high degree of efficiency with firearms and other equipment he will use.

Upon graduation, which is held with colorful ceremonies, he is assigned to a duty post. In the determination of this, his choice is followed as closely as possible and practical but he cannot be assigned to his home county. This regulation is not so much to conform with the saying, "A prophet is not without honor save in his own country,"

as to minimize the possibility of embarrassing contacts with friends or relatives, either among violators or local officials.

After he is permanently assigned, he returns to the training school one week each year for in-service training on latest methods, developments and procedures, and four times a year must qualify with all types of firearms used by the department. There are no specialists as such. All members are expected to be proficient in all types of work and qualified for any task assigned. Before becoming eligible for promotion their periodic merit ratings must be better than satisfactory and they must complete a special written competitive examination with grades an important factor for consideration when a vacancy in an upper bracket occurs.

Quite often, a member is selected to attend such recognized institutions as Northwestern University Traffic Institute or the F.B.I. National Academy. These men pass on to other members the training they have absorbed.

As a trooper, a member can reach the pay level of $4,184, receives all uniforms and equipment, is reimbursed for a meal per day while on duty and is paid all expenses incurred in a travel status. It has been the strict policy of the department to promote from within and, indeed, each supervisory officer from superintendent to sergeant started with the department as a trooper and worked upward.

Personnel of Virginia Department

Organization begins with the superintendent, with rank of colonel, who is directly responsible to the Governor since the department is a self-acting entity of our state government. Under the superintendent is the executive officer with rank of major.

Four of the five Administrative Headquarters divisions are headed by captains and the fifth by a lieutenant. These consist of Property and Finance, responsible for supplies, equipment other than communications, buildings, grounds and accounts; Personnel and Training, covering recruiting, training and administration of the merit system; Safety, which covers accident records, interdepartmental safety, motor vehicle inspection for the entire state, appliance

approval and the activities of the state Governor's Highway Safety Committee; Communications, including installation and maintenance of equipment; and Investigation and Records under which come identification, criminal records, arrest records, activities reports, teletype operation and laboratory work.

The captains heading the Investigations and Records and Safety Divisions are assisted by one lieutenant each, while the Personnel and Training Division includes a lieutenant and two sergeants responsible for the administration of the Basic Training and in-service training schools. The building and facilities are also open periodically to classes conducted for municipal and county officers.

Accountable directly to the superintendent and executive officer is the field supervisor who is a major. Under him are five field divisions, by territory, each headed by a captain. These are broken into nine districts, under lieutenants, and further into thirty-one areas, under sergeants. They include duty posts, each manned by one or more troopers who are assigned in accordance with traffic flow and accident frequency.

An additional sergeant is assigned to the headquarters of each of the five field divisions and four duty sergeants are located at Administrative Headquarters.

Administrative Headquarters is situated three miles southwest of Richmond and consists of a large building housing offices, storerooms, and an assembly room with a museum and art gallery of portraits, donated by Virginia artists, of all uniformed personnel who died in the line of duty or who were killed in action during the last war. In conjunction with Administrative Headquarters are the training school, communications building, landing field and hangar, and garage with the entire grounds including eighty-seven acres.

Each division has its own headquarters building, and in three cases where the situation justifies there are sub-stations. These buildings have both radio and teletype facilities, offices, a recreation and assembly room, and sleeping quarters for personnel in transit or on special duty. Each area has its own office room centrally located. Civilian personnel perform important non-police duties both at headquarters and permanent field establishments.

Basically, the function of the Virginia State Police is the prevention of traffic accidents. This of course includes patrol, accident investigation, arrests and warnings as the main components. Other activities for which the department is responsible include administering the statewide semi-annual motor vehicle inspection program which is handled through private stations appointed and controlled by the department, as far as the inspection program is concerned; and the operation of permanent roadside scales in conjunction with the Highway Department to enforce the established weight limits for trucks. The department also maintains portable scales for use on routes by-passing the permanent scales.

Other Functions of the Virginia State Police

Under the theory that any group officially charged with the promotion of safety should have its own house in order, the department operates a vigorous in-service safety program with both individual and divisional awards.

We assist in the certification of school teachers who will instruct in driver-training, and maintain a publicity program through films, posters, literature, talks and other media. Frequently individual members appear on radio and television programs as well as prepare articles for local newspapers. Periodic road checks are held at various locations in a search for unsafe vehicles and to determine whether drivers are properly licensed and their automobiles legally registered in their names.

In addition to armored cars and portable lights for emergencies, the department operates a small air-arm consisting of four planes. Piloting is on a voluntary basis.

Broadly speaking, I believe the main functions of any state police department, in addition to accident prevention, should be to furnish the highest degree of cooperation to local enforcement agencies and to have available a mobile, trained body for emergency use where conditions become out of control on a large scale anywhere in the state.

While the Virginia State Police have a policy of working as closely as possible with other law enforcement agencies, adverse

situations often call for immediate action and our troopers are trained and equipped to handle any reasonable emergency. Through our teletype system and connections, we are in contact with all division headquarters, sub-stations and other law enforcement agencies while the individual trooper can be reached through his car radio.

Primarily, we concern ourselves with traffic duties, but it is inevitable that such an organization as ours be active in other emergency police duties and we are empowered by the Code of Virginia to enforce any laws of the Commonwealth.

Just under 98 percent of our arrests involve the highway in some manner but any time traffic deaths begin to rise or there is a particularly high score for a weekend, the hue and cry goes up, "Why don't the State Police stay where they belong and stop this slaughter?" In my opinion, the simple answer lies in another question. "What stature would any uniformed law-enforcement officer, or his department, hold in the eyes of the public should he let the appeal of a citizen in distress go unanswered or ignore a violation of the law on the grounds he is concerned with traffic duties only?" We do not seek other duties unless called by other law enforcement agencies or to a location where there are none; but in the 40,815 square miles of Virginia many situations arise where an officer is needed and needed immediately.

Another duty that consumes man-hours is the manning of truck scales. While at first glance it might seem that this duty could be well handled by civilian or deputized personnel of the Highway Department, there is another side to the picture. The stopping of literally thousands of trucks a day can disclose other violations than those of excess weight, and many of these do come to light. There are also drivers who, unknowingly or otherwise, attempt to run past the scales. Consequently, we believe that a trained and bona fide police officer is a necessary adjunct. Time and conditions permitting, he not only issues the necessary summons in the event of a weight violation but checks operators' licenses and registrations; investigates for violations of the Motor Carriers' Act; examines and tests safety devices and equipment; seeks to identify drivers who are delinquent in previously assessed fines and for whom capii may have been issued;

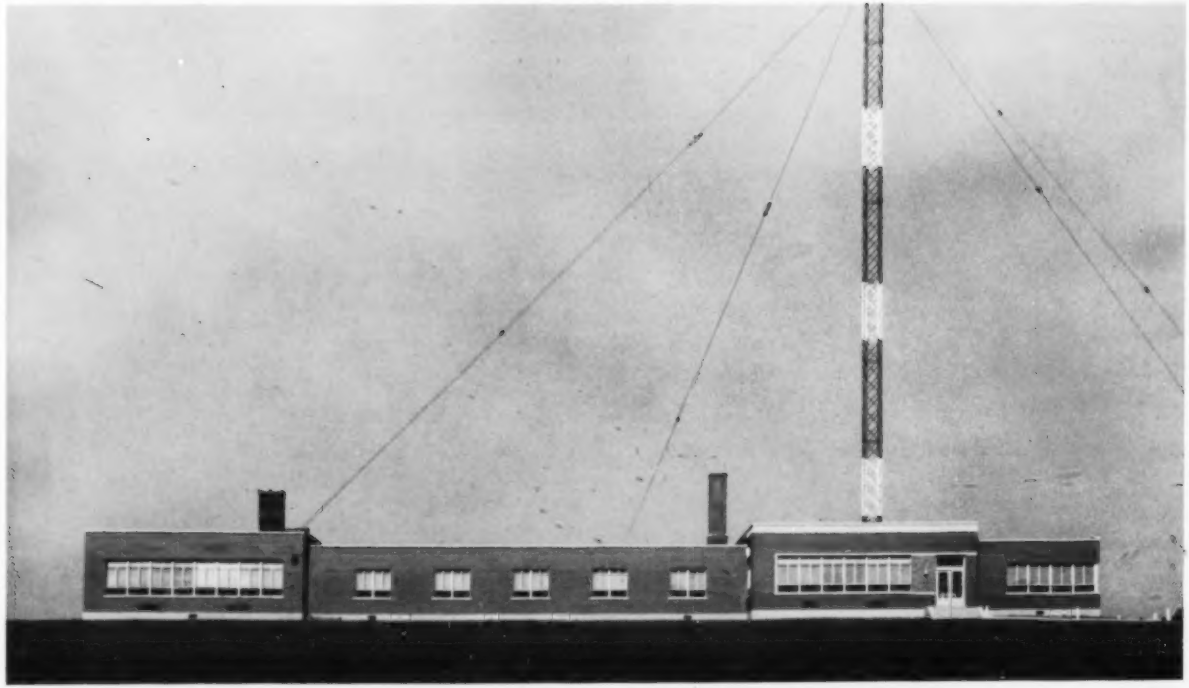


FIGURE 1. Basic Training School, Virginia State Police. Radio Tower in Background.

FIGURE 2. Aerial View of State Police Headquarters. Main Building in Foreground. Immediately Behind to Left is Communications Building and on Right is Garage. In Background is Basic Training School.

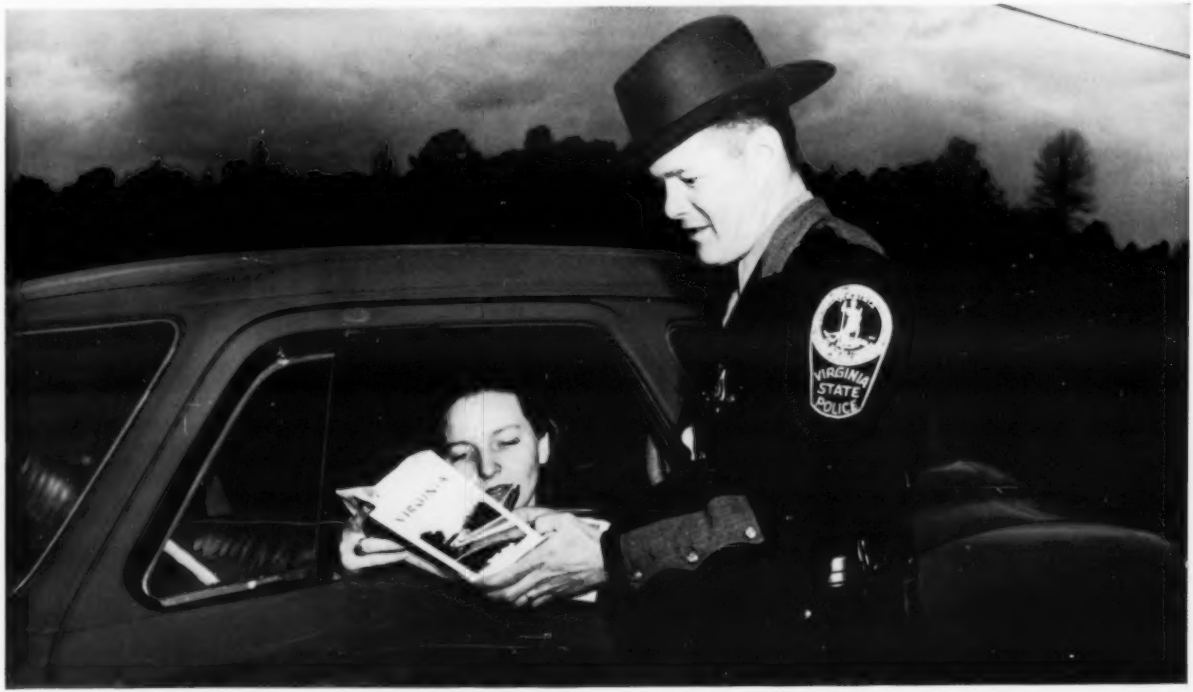


FIGURE 3. Help for the Tourist is a Part of the Trooper's Work.

FIGURE 4. A Division Captain Participates in a Flight for Crippled Children.

enforces the dimension laws, and regulates traffic. These duties in the hands of an untrained man could well lead to trouble.

Public Opinion and Police Problems

While a whole-hearted spirit of cooperation exists between our State Police, Highway Department, and Division of Motor Vehicles, the general public is often not aware that each is an independent department of our state government. Each is charged with certain responsibilities and duties but these the citizen sometimes confuses and thus can difficulties and misunderstandings arise.

Most discouraging is the necessity of facing the public tendency to blame the police and the police alone for a high death rate. A police officer can only make an arrest and present his testimony in court. He can go no further. Enforcement consists of the proper laws to be enforced, the arrest, and the procedure in court. Sure, swift, and just punishment has a salutary effect which is undermined by acquittal or a nominal fine following a gross moving violation.

Here, we now have a law empowering the Division of Motor Vehicles to suspend for sixty days the license of any driver convicted twice within a year for violations of any speed-regulatory laws. In spite of the fact that the Division so acts only after two proper convictions in court, it is classified by a part of the public as a bureaucracy snatching the power to act as judge, jury and prosecutor. Since this law went into effect, we have had a healthy reduction in deaths despite steadily rising traffic volumes.

To digress briefly, we have found this measure to be most effective in dealing with the habitual violator. He learns how much his license means to him and that it is a revokable privilege rather than a demandable right. In addition, his circle of acquaintances receives an excellent object lesson not present when the violator merely pays a fine.

To deal with the alert violator, it has been our policy to use some unmarked cars. This brings the accusation of entrapment. There are two sides to the picture: the marked cars exert a prohibitive effect on the would-be but timid violator and his mate, the unconscious violator. Some drivers, however, are so watchful that they cannot be

apprehended without plain cars, and the knowledge that these are on the road slows them down. Yet the very people who decry this method have nothing to say when a plain-clothes detective tracks down a petty thief. To achieve each end, the Virginia State Police use both marked and unmarked cars. Incidentally, we no longer use motorcycles for enforcement work.

We receive, as does every other state traffic enforcement agency, criticisms on the speeds of commercial vehicles although, in proportion to the number on the road as compared to private vehicles, we arrest a larger percentage of commercial than of private drivers. This public attitude no doubt is due to the deeper impression made upon a witness when a large, conspicuous vehicle is seen in violation or in an accident, and the fact that large vehicles appear to be moving faster than they really are because of size and noise.

The modern state police administrator should have a good appreciation of public relations for it is public attitude and nothing else which has engendered one of our most pressing social problems. To paraphrase Oscar Wilde, we might say that when bad driving is looked upon as vulgar, we shall have no more of it. Certainly when public opinion brings the drunken driver into some degree of the social disrepute a man arrested for drunkenness afoot must bear; when it looks upon the driver who is lethally discourteous in traffic with some small measure of the disapproval that frowns upon a gross social error, and when it realizes that unnecessary and selfish acts which annually kill 40,000 people fully merit Coventry and severe legal punishment for their perpetrators, conditions will improve.

Traffic laws are not as comprehensive as they might be because people do not desire them that way. Penalties are too often ridiculously inadequate for dangerous offenses because the public does not demand that penalties fit the offense.

More convictions are not obtained because the citizen places himself sympathetically in the shoes of the violator on trial and refuses to testify properly as a witness or to convict as a juror. In addition, he refuses to take out a warrant for and present evidence in court against a dangerous driver. In other words, bad driving is considered a white collar offense which doesn't merit stern punishment.

To meet this attitude, the state trooper must command respect. He must present a favorable appearance, speak well and perform his duty with as little unpleasantness as the situation permits. There can be none of the "where's the fire" approach but rather the violator should be made to feel ashamed of his actions. We are not "speed cops" but officers and, we hope, gentlemen who have dedicated our careers and our lives "to the preservation of human life and property" and this we strive to do without "fear, favor or prejudice." It should be the solemn duty of all police officers to work toward the elevation of police ethics and standards.

The geography of Virginia is such that the trooper is generally isolated in his work and decisions must be his own. We hope his training and the precedents set for him have developed a well-rounded officer with high professional standards and the desirable quality of leadership. He knows he can make friends for himself and his department by such actions as assisting a stranded motorist, speaking before a school or other group and participating in local civic activities. Much of this must be done on his off-duty time but he has found that it pays and pays well.

No one enjoys being arrested and almost invariably a violator can honestly convince himself that he was not at fault to the extent arrest is necessary, or that he is a victim of persecution. However, we can truthfully say that commendations by letter from those arrested outnumber our complaints.

This is encouraging as it demonstrates public esteem on the first level and we are equally happy to see our members holding office and participating in various civic organizations. On a national scale, some of us continually are asked to serve as committee members of such groups as the International Association of Chiefs of Police, the American Association of Motor Vehicle Administrators and the Uniform Code Committee.

None of us is perfect and no organization is without its limitations and imperfections. However, we of the Virginia State Police can only strive to approach nearer our ideal—an ideal best expressed by the "Trooper's Pledge" with which each member renews his oath upon graduation from basic training school:

"Humbly recognizing the responsibilities entrusted to me as a

member of the Virginia State Police, an organization dedicated to the preservation of human life and property, I pledge myself to perform my duties honestly and faithfully to the best of my ability and without fear, favor or prejudice.

"I will aid those in danger or distress, and will strive always to make my state and my country a safer place in which to live. I will wage unceasing war against crime in all its forms, and will consider no sacrifice too great in the performance of my duty.

"I will obey the laws of the United States of America and of the Commonwealth of Virginia, and will support and defend their Constitutions against all enemies whomsoever, foreign and domestic. I will always be loyal to and uphold the honor of my organization, my state and my country."

Vehicular Trip Distribution by Successive Approximations

THOMAS J. FRATAR

Mr. Fratar is an associate of a New York firm of engineers, in charge of traffic, transportation and economic surveys. He has supervised numerous planning studies for highway, airport, marine and railroad projects. During World War II, he served with the U. S. Army as a valuation engineer in the operation of the Iranian State Railroad. Prior to that he was associated with the Yale Bureau of Highway Traffic on research studies dealing with highway transportation. The method of traffic distribution described in this article was applied in the analyses of Cleveland Metropolitan Area traffic for Cuyahoga County, Ohio.

MOTORISTS in following their normal pursuits travel in traffic patterns which can be readily measured. The highway planning engineer must see beyond those patterns to ones that will exist in the future, to design highway networks adequate for the traffic loads imposed on them during their useful life without wasteful surpluses of capacity. It is generally recognized that prediction of such traffic loads by expanding present patterns on a uniform community-wide basis is often grossly inaccurate. This is particularly true where the rates of growth are substantially different in various portions of the area to be served. It is also recognized that separate expansion of each existing interzonal movement does not produce results which agree with the anticipated conditions of growth for the various portions of the area.

The method for predicting future interzonal volumes by successive approximations, described in this article, is based on this premise: If the character and growth conditions of traffic zones are known, or can be predicted, it is possible to estimate with equal dependability the total trips that will be made to and from each zone, and the distribution of those trips in interzonal travel. By this method, the anticipated traffic of each zone is assigned to the desire lines of that zone according to the apparent relative importance of each desire line.

When this initial assignment is completed for all zones, each movement has been given two volumes—one for each zone involved in the movement. The respective pairs of volumes are averaged and the averaged values are added for each zone, adjusted to agree with the anticipated totals, and again distributed. The new distribution reflects the apparent relative importance of the desire lines as indicated in the completed summation by zones of the averaged volumes. The procedure is repeated until the desired degree of conformity is obtained between the anticipated totals and the assigned totals for each zone.

The distribution obtained by this method of successive approximations is consistent in that the number of trips assigned to each interzonal movement is proportional to the movement's relative attractiveness, and the sum of all the trips assigned to and from each zone equals the number anticipated for it. With the use of electronic calculators, or similar business machines, the distribution process is rapid and relatively economical.

This approach to the distribution of traffic is believed to be unique although methods of solving similar complex problems by successive approximations are well-known and extensively used in structural engineering, tidal hydraulics and other fields.

Travel Habits and Traffic Patterns

Each vehicular trip on a highway network is prompted by a motive —to go to work, to go shopping, to go to school, to go home, or to engage in any of the numerous pursuits of community life. In any area and for any time the trips and purposes can be determined and the travel pattern can be established.

If the various parts of an area remain unchanged or if they change in a uniform way, the future traffic pattern will be the same as, or a uniformly expanded copy of, the existing pattern. That is rarely the case. More often portions of an area remain fairly stable while other portions expand or diminish. The future distribution of traffic will reflect those conditions—trips to and from the stable areas will remain unchanged; trips to and from expanding areas will increase and trips to and from diminishing areas will decrease.

Estimates of future volumes that will enter and leave the various zones of an area are readily arrived at by considering for each zone the prospective land use, the population trend, the prospective industrial and business activity, the likely changes in shopping, recreational, social, medical and educational facilities, the probable trend in automobile usage and similar matters. For example, if a zone is entirely residential in character, the estimate of future trips to and from it will be based on the zone's anticipated future population and the anticipated trips per capita; if a zone is entirely industrial in character, the estimate of future trips to and from it will be based primarily on the anticipated future employment and the anticipated automobile usage in that zone.

For any given area traffic volumes which can logically be expected to enter and leave each zone in the future can be similarly estimated. This is the simplest part of the problem. The next step, an extremely important one, is the determination of the logical distribution of those trips among the various possible desire lines of travel.

Methods of Distribution Previously Used

Two general methods have been used for estimating the future volumes and distribution of interzonal traffic. By one of these methods a single expansion factor is applied uniformly to all interzonal movements. This procedure can lead to conclusions far from correct when significant changes occur in concentrations of population, business and industry, or in the economic characteristics of the various zones. By the other method, each interzonal movement is expanded by multiplying it by the arithmetic or geometric mean of the factors representing the probable traffic growth of the two zones involved in the movement. An obvious error in this method is the discrepancy between the summation of the expanded trips to and from any zone and the anticipated trips for that zone.

Distribution by Successive Approximations

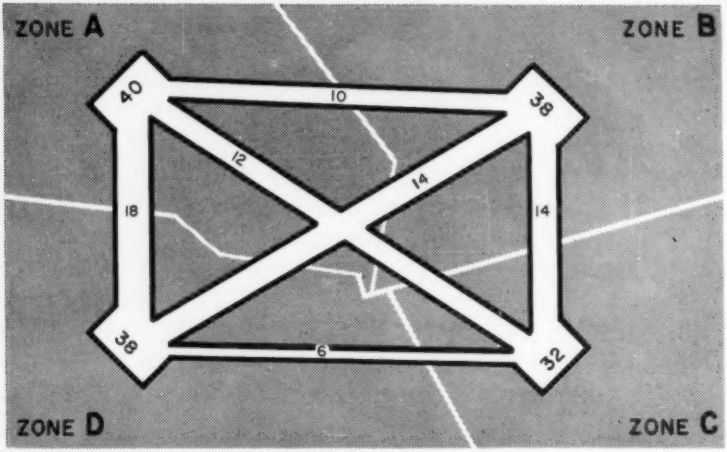
The first step in the distribution of interzonal trips by successive approximations is to estimate the number of trips which can be ex-

pected to enter and leave each traffic zone. These estimations can be made, as described above, on the basis of various trends and the prospective changes in the characteristics of the individual zones. In this step the relation of each major community pursuit to the community as a whole is considered and care is taken to see that the anticipated future development reflects, for the anticipated population, a proper balance of industry, business, shopping activity, educational activity, recreational activity and similar interrelated community affairs.

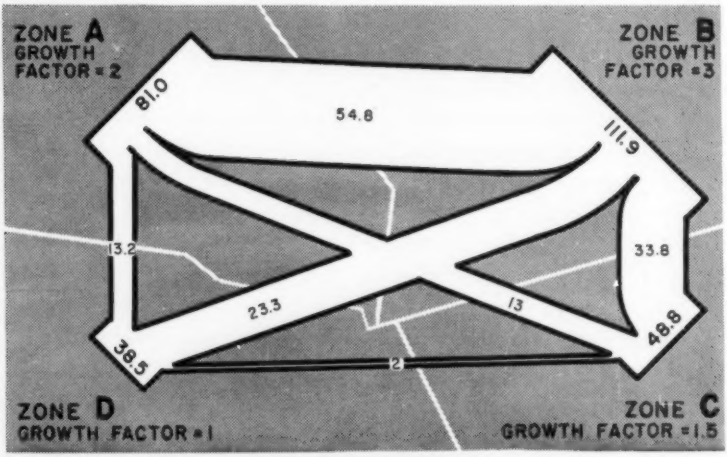
The next step is to determine the relative attractiveness of each interzonal movement. An indication of the current attractiveness of any movement is its current size. The attractiveness in the future will be modified by the anticipated growth of the zones involved. A distribution pattern which will satisfy these conditions of attractiveness can not be arrived at directly because of the great complexity of the problem. Resort is made, therefore, to a procedure of successive approximations.

The total trips for each zone are distributed to the interzonal movements, as a first approximation, according to the relative attractiveness of each movement. Thus, the future trips estimated for any zone would be distributed to the movements involving that zone in proportion to the existing trips between it and each other zone and in proportion to the expected growth of each other zone. When the future traffic into and out of all zones is similarly distributed, each interzonal trip has been assigned two tentative values—one, the result of the distribution for one of the zones involved and the other, the result of the distribution for the other zone involved. As a first approximation these pairs of tentative values are averaged.

For each zone the first approximation of interzonal volumes are added and the sum is divided into the desired total for the zone to obtain a new "growth factor." Using the growth factors thus obtained and the first approximation volumes, the distribution process is repeated and second approximation volumes and growth factors are determined. It appears from preliminary analyses that each successive cycle in the procedure reduces the average difference between the desired totals and the respective adjusted totals by a substantial amount. The process can be continued to any desired degree of conformity.



DISTRIBUTION OF EXISTING TRIPS



DISTRIBUTION OF FUTURE TRIPS
(AS FOUND BY FOUR APPROXIMATIONS)

FOUR ZONE PROBLEM

Example of Proposed Method

The following computations for a simple four-zone problem illustrate the proposed procedure. The situation is shown in Figure 1 and is summarized below.

PRESENT NUMBER OF INTERZONAL TRIPS

Zones	A	B	C	D
A	–	10	12	18
B	10	–	14	14
C	12	14	–	6
D	18	14	6	–
Present Totals	40	38	32	38
Estimated Future Totals	80	114	48	38
Growth Factors (Ratio of Present Totals to Future Totals)	2	3	1.5	1

For zone A the future traffic volume of 80 trips would be distributed to the interzonal movements AB, AC and AD in proportion to the attractiveness of those movements at A; and for zone B the future traffic volume of 114 trips would be similarly distributed to interzonal movements AB, BC and BD according to the attractiveness of those trips at B. The volume of AB in each case would be:

$$\frac{\text{The future trips into and out of the zone considered (A or B) } \times \text{ existing trips along AB } \times \text{ growth factor of opposite zone}}{\text{Sum of products of existing trips of the zone considered (A or B) and the respective opposite growth factors}}$$

The distribution to AB at A would be:

$$\frac{80 \times 10 \times 3}{10 \times 3 + 12 \times 1.5 + 18 \times 1} = 36.4$$

and the distribution to AB at B would be:

$$\frac{114 \times 10 \times 2}{10 \times 2 + 14 \times 1.5 + 14 \times 1} = 41.5$$

Computations for the first approximation for each of the four zones are summarized below. Line 1 for each summary shows the existing trips for the indicated interzonal movement. Line 2 shows for each

zone the interzonal trips multiplied respectively by the growth factor of the other zone involved. These products are summarized for each zone to provide a common denominator for the distribution of trips of that zone. This distribution is accomplished by dividing the common denominator into the total trips desired for the zone, and multiplying the quotient by the products shown in line 2. The new distribution, shown in line 3, necessarily adds up to the total number of trips desired for the zone.

FIRST APPROXIMATION

Zone	A	B	C	D	Sum of Products of Trips and Growth Factors	Desired New Total Trips	Ratio of Desired New Total Trips to Sum of Products
Growth Factor	2	3	1.5	1			
For Zone A							
(1)	–	10	12	18			
(2)	–	30	18	18	66	80	1.21
(3)	–	36.4	21.8	21.8	80		
For Zone B							
(1)	10	–	14	14			
(2)	20	–	21	14	55	114	2.07
(3)	41.5	–	43.5	29.0	114		
For Zone C							
(1)	12	14	–	6			
(2)	24	42	–	6	72	48	.667
(3)	16.0	28.0	–	4.0	48		
For Zone D							
(1)	18	14	6	–			
(2)	36	42	9	–	87	38	.437
(3)	15.8	18.3	3.9	–	38		

The pairs of interzonal volumes obtained by these computations are averaged as shown below to obtain the first approximation for interzonal trips.

	A–B	A–C	A–D	B–C	B–D	C–D
	36.4	21.8	21.8	43.5	29.0	3.9
	41.5	16.0	15.8	28.0	18.3	4.0
	77.9	37.8	37.6	71.5	47.3	7.9
First Approximations	39.0	18.9	18.8	35.7	23.6	4.0

The averages for the trips radiating from each zone are next summarized to determine new growth factors to be used in the second approximation as shown below.

	A	B	C	D
	39.0	39.0	18.9	18.8
	18.9	35.7	35.7	23.6
	18.8	23.6	4.0	4.0
New Totals	76.7	98.3	58.6	46.4
Desired Totals	80.0	114.0	48.0	38.0
New Growth Factors	1.04	1.16	.82	.82

Additional cycles of approximations and corrections could be made as shown below.

SECOND APPROXIMATION

Zone	A	B	C	D	Sum of Products of Trips and Growth Factors	Desired New Total Trips	Ratio of Desired New Total Trips to Sum of Products
New Growth Factors	1.04	1.16	.82	.82			
For Zone A							
(1)	–	39.0	18.9	18.8			
(2)	–	45.3	15.5	15.4	76.2	80	1.05
(2)	–	47.5	16.3	16.2	80		
For Zone B							
(1)	39.0	–	35.7	23.6			
(2)	40.5	–	29.3	19.7	89.5	114	1.275
(3)	51.6	–	37.3	25.1	114		
For Zone C							
(1)	18.9	35.7	–	4.0			
(2)	19.7	41.4	–	3.3	64.4	48	.746
(3)	14.7	30.8	–	2.5	48		
For Zone D							
(1)	18.8	23.6	4.0	–			
(2)	19.6	27.4	3.3	–	50.3	38	.755
(3)	14.7	20.7	2.6	–	38		

	A–B	A–C	A–D	B–C	B–D	C–D
	47.5	16.3	16.2	37.3	25.1	2.5
	51.6	14.7	14.7	30.8	20.7	2.6
	99.1	31.0	30.9	68.1	45.8	5.1
Second Approximations	49.6	15.5	15.4	34.0	22.9	2.5

	A	B	C	D
	49.6	49.6	15.5	15.4
	15.5	34.0	34.0	22.9
	15.4	22.9	2.5	2.5
New Totals	80.5	106.5	52.0	40.8
Desired Totals	80.0	114.0	48.0	38.0
New Growth Factors	1.0	1.07	.92	.93

THIRD APPROXIMATION

Zone	A	B	C	D	Sum of Products of Trips and Growth Factors	Desired New Total Trips	Ratio of Desired New Total Trips to Sum of Products
New Growth Factors	1.0	1.07	.92	.93			
For Zone A							
(1)	–	49.6	15.5	15.4			
(2)	–	53.0	14.2	14.3	81.5	80	.982
(3)	–	52.0	13.9	14.1	80		
For Zone B							
(1)	49.6	–	34.0	22.9			
(2)	49.6	–	31.3	21.3	102.2	114	1.114
(3)	55.4	–	34.9	23.7	114		
For Zone C							
(1)	15.5	34.0	–	2.5			
(2)	15.5	36.4	–	2.3	54.2	48	.887
(3)	13.7	32.3	–	2.0	48		
For Zone D							
(1)	15.4	22.9	2.5	–			
(2)	15.4	24.5	2.3	–	42.2	38	.90
(3)	13.8	22.1	2.1	–	38		

	A–B	A–C	A–D	B–C	B–D	C–D
	52.0	13.9	14.1	34.9	23.7	2.0
	55.4	13.7	13.8	32.3	22.1	2.1
	107.4	27.6	27.9	67.2	45.8	4.1
Third Approximations	53.7	13.8	14.0	33.6	22.9	2.0

	A	B	C	D
	53.7	53.7	13.8	14.0
	13.8	33.6	33.6	22.9
	14.0	22.9	2.0	2.0
New Totals	81.5	110.2	49.4	38.9
Desired Totals	80.0	114.0	48.0	38.0
New Growth Factors	.98	1.035	.973	.98

FOURTH APPROXIMATION

Zone	A	B	C	D	Sum of Products of Trips and Growth Factors	Desired New Total Trips	Ratio of Desired New Total Trips Sum of Products
New Growth Factors	.98	1.035	.973	.98			
For Zone A							
(1)	–	53.8	13.8	14.0			
(2)	–	55.7	13.4	13.7	82.8	80	.967
(3)	–	53.8	13.0	13.2	80		
For Zone B							
(1)	53.8	–	33.6	22.9			
(2)	52.7	–	32.7	22.5	107.9	114	1.055
(3)	55.7	–	34.5	23.8	114		
For Zone C							
(1)	13.8	33.6	–	2.0			
(2)	13.5	34.8	–	2.0	50.3	48	.953
(3)	12.9	33.1	–	2.0	48		
For Zone D							
(1)	14.0	22.9	2.0	–			
(2)	13.7	23.7	2.0	–	39.4	38	.965
(3)	13.2	22.8	2.0	–	38		

	A–B	A–C	A–D	B–C	B–D	C–D
	53.8	13.0	13.2	34.5	23.8	2.0
	55.7	12.9	13.2	33.1	22.8	2.0
	109.5	25.9	26.4	67.6	46.6	4.0
Fourth Approximations	54.8	13.0	13.2	33.8	23.3	2.0

	A	B	C	D
	54.8	54.8	13.0	13.2
	13.0	33.8	33.8	23.3
	13.2	23.3	2.0	2.0
New Totals	81.0	111.9	48.8	38.5
Desired Totals	80.0	114.0	48.0	38.0
New Growth Factors	.99	1.02	.985	.985

For this simple four-zone problem, the maximum difference for any zone between the desired total number of trips and the adjusted total was about 3.5 percent at the end of the third cycle and about 2 percent at the end of the fourth cycle. Each successive cycle reduced the difference by about one half.

As can be seen from this example, manual procedures are entirely impracticable for other than extremely simple problems like the one illustrated. However, it can also be seen that the procedures are repetitious and each is in itself relatively simple. Because of this, an extensive problem of any conceivable complexity can be readily set up for rapid analysis by business machine methods.

Summary of the Method

1. The first step is the preparation of dependable estimates of the total number of automobile trips that can be expected to enter and leave each traffic zone of the area under study at the future date for which the distribution is desired. These estimates must have a possible distribution—no one zone can have more trips into and out of it than enter and leave all the other zones combined.
2. The total trips of each zone are distributed to the other zones in proportion to the attractiveness indicated by existing interzonal volumes and by the anticipated growth of each of the other zones.
3. The distribution of trips for all zones will produce two tentative values for each interzonal movement. These pairs of tentative values are averaged to obtain the first approximation of the interzonal volumes.
4. For each zone, the sum of the first approximation volumes is divided into the total volume desired for the zone to obtain first approximation growth factors to be used in the computations for the second approximations.
5. The originally estimated trips for each zone are again distributed to interzonal movements, these new assignments being in proportion to the interzonal volumes and growth factors obtained by the first approximation. The pairs of tentative volumes obtained by this distribution are averaged as before, and the process repeated until the desired conformity is obtained.

Comparison with Average Factor Method

If it is determined that the trips into and out of a zone will change in a definite way, the proposed method will provide a solution com-

patible with the anticipated change. For the four-zone example described above, the results by the method of successive approximations and by the method of averaging growth factors would be as follows:

ESTIMATED INTERZONAL TRIPS

	A–B	A–C	A–D	B–C	B–D	C–D
Computed at end of Fourth Approximation by successive approximation method	54.8	13.0	13.2	33.8	23.3	2.0
Computed by method of Averaging Growth Factors	25.0	21.0	27.0	31.5	28.0	7.5

and the totals for the zones would be:

	A	B	C	D
Desired Totals	80	114	48	38
Totals at the end of Fourth Approximation by successive approximation method	81	111.9	48.8	38.5
Totals which would be obtained by the method of averaging growth factors	73	84.5	60	62.5

For this example the totals obtained by the method of averaging growth factors is at considerable variance with the respective totals desired. The future volume of Zone D, for example, was increased about 90 percent by the averaging method, although the total volume of Zone D is expected to remain unchanged.

The method of successive approximations described herein will undoubtedly raise many questions in readers' minds. A few of these questions are discussed below:

Can a negative number be obtained for an interzonal traffic movement?

The growth factors are always positive, being less than one when the activity for a zone is anticipated to be less in the future than at present. Consequently, although the volume for any interzonal movement may diminish, the proposed method cannot produce a negative number.

How does interzonal accessibility affect the solution?

The suppression of trips because of inadequate accessibility is not accounted for in the procedure, but must be taken care of in the facility generation factor applied after a definite route is laid out to connect the two zones.

Does a change in the volume moving among one desired line of travel affect the volumes along other lines of travel?

The method distributes the future trips in accordance with assumed conditions. For different assumed conditions, the interzonal volumes must also be different inasmuch as the total number of trips is predetermined. The apparent influence is one of effect and not cause.

For a large urban area, how many cycles of approximations are required?

The method described herein was used to estimate the interzonal distribution of traffic in Cuyahoga County, Ohio, for the year 1975. Approximately 386 zones or combinations of zones were involved, with expansion factors (1952 to 1975) greater than three for some zones. The total anticipated 1975 passenger-vehicle traffic was about 6,170,000 trips, expanded from about one-half that number in 1952. At the end of the first approximation, the maximum difference between the desired volume and the distributed volume for any zone was 33 percent but the difference for more than three-quarters of the zones was less than 5 percent. At the end of the second approximation, the maximum difference was about 8 percent and the difference for most of the zones was negligible.

Acknowledgments

The author first began to investigate the possibility of estimating traffic distribution by a method of successive approximations in 1941 at the suggestion of Professor Hardy Cross of Yale University. The investigations at that time were directed at analyzing the distribution of traffic on competitive routes in a network of highways.

The method described in this article is intended for estimating

the future desired movements of traffic without regard to routes and lends itself more readily to analysis by a method of successive approximations than does the problem of the distribution of traffic on competitive routes. The author is indebted to many persons for inspiration received from discussions with them, and particularly to Mr. Glen E. Brokke.

Marketability of Toll Bond Issues

J. L. JEFFERS

Since 1934, Mr. Jeffers has been associated with a firm of underwriters and distributors of corporate and municipal securities. This company, active in the development of "revenue" issues, has been identified as principal underwriter or participant, with nearly all the issues listed in the tabulation presented with this article. Previously Mr. Jeffers spent seven years in the investment division of a national bank in Chicago.

TOLL facility revenue bonds in most instances are obligations of governmental bodies payable solely from revenues derived from toll charges for the use of the facility, without recourse to taxing power. This discussion includes a tabulation of sixty-eight municipally owned toll facilities, showing the amount of the original issue, the amount of bonds outstanding as of December 31, 1952, the gross revenue of each for 1950, 1951 and 1952 compared with the earnings estimated by the engineers prior to construction or acquisition of the project, and the percentage ratio of actual earnings to estimated earnings.

This tabulation was prepared, not with the idea of keeping score on the engineers, but as a sales exhibit for revenue bond issues showing the relationship of actual earnings to estimates prepared by traffic engineers at the beginning of the projects. The majority are earning gross revenues far above estimates, many having actually doubled the estimated revenues. Some of the original bonds have been retired at the call price for refunding purposes and several issues have been redeemed in full and the facilities made free of tolls. The report lists a total of more than $1,657 million of revenue bonds issued for the various toll projects.

Toll Roads Date From 1795

In the early years of this country most road-building was confined to centers of population. Such inter-community roads as were built, private capital often financed through charters allowing the col-

lection of tolls. These toll roads, beginning in 1795, were called "turnpikes" and were built of broken stone crushed into place by passing horse-drawn vehicles. Some of these turnpikes like the Old York Road from Philadelphia towards New York, the Baltimore and Lancaster Pikes, also out of Philadelphia, remained until well after the close of the last century, but many of them were abandoned by 1850. They failed financially because the development of steam railroads took away their business.

The opening of the Pennsylvania Turnpike in 1940 marked the beginning of a new turnpike era. A portion of the Maine Turnpike was opened to traffic in 1947 and the New Jersey Turnpike was completed in 1952. The Oklahoma Turnpike began operating in 1953. In a few years it will be possible for a driver to enter a toll highway at Augusta, Maine, and drive to Chicago with a choice of routes through New York State, Canada and Michigan, or New Jersey, Pennsylvania, Ohio and Indiana, all on controlled access superhighways.

With the exception of the Pennsylvania Turnpike, these highways are being financed or have been financed entirely with revenue bonds. The Pennsylvania Turnpike received a forty-five percent Public Works Administration grant and a loan from the Reconstruction Finance Corporation for the balance.

For spans of unusual magnitude and cost, also for interstate and international crossings, toll bridges and tunnels came to be the solution of the financing problem. Up to 1929, most of the toll spans were built under private ownership, but later, toll bridges in the United States were built by public commissions or authorities. Toll facilities are financed, as a rule, by issuing revenue bonds secured only by prospective earnings, so that the user pays for them until they become free instead of adding them to the general tax burden. The motoring public has thus secured the benefit of many needed bridges, tunnels and roads that would otherwise have remained unattainable.

Sinking Fund Operation

A routine provision of the legal proceedings authorizing the issuance of toll revenue bonds is the covenant that whenever the sinking fund has a surplus in excess of interest and reserve requirements, it may be

used from time to time for purchasing bonds in the open market at the lowest prices reasonably obtainable, but not exceeding the price at which the bonds are callable on the next interest-payment date. If bonds cannot be purchased on these terms, available funds must be used to call bonds for redemption. This provision accounts for the fact that the majority of issues of established operating toll projects trade in the open market at a price close to the redemption price of the bonds. Of all the factors affecting the marketability and liquidity of a security, the constant operating of a sinking fund is a leading factor in stabilizing and maintaining market value.

For most investments, marketability or liquidity might be defined as the quality which makes an investment readily acceptable to a large number of buyers. Since the marketplace for the vast majority of securities is with insurance companies and banks, for practical purposes the liquidity of the investment depends largely upon the attitude of these institutions toward it. Because nearly all insurance companies and banks are influenced by the same ideas and circumstances at the same time, they are almost compelled to act concurrently and in a practically uniform manner; therefore an investment normally desirable to these institutions may have an extremely volatile market at the very time when marketability is really most necessary.

For example, the extraordinary swings of supply and demand and market value over the last three years is shown by Moody's municipal and corporate bond yield averages. The municipal bond yield averages ranged from 1.60 percent in February, 1951 to 3 percent in June, 1953, which represents a decline of twenty-three points for a twenty-year 2 ½ percent bond. The all corporate bond yield ranged from 2.85 percent in February, 1951 to 3.64 percent in June, 1953, a decline of eleven points for a twenty-year 3¼ percent bond. During this same period, because of regular sinking fund operations the bonds of a majority of the established operating toll projects have consistently sold at or close to their redemption prices.

In accordance with the proceedings authorizing and providing for the issuance of most toll bonds, revenue is applied

1. to the payment of operation and maintenance expenses;
2. to establish required reserves, and
3. to interest and sinking fund.

A sample of the sinking fund provisions of certain representative bonds is given below:

$75,000,000 Maine Turnpike Authority Revenue 4 percent Bonds Due January 1, 1989

Moneys held for the credit of the redemption account shall be applied to the retirement of bonds as follows: The Trustee shall endeavor to purchase bonds at the most advantageous price obtainable with reasonable diligence, at a price not to exceed the call price of the bonds and if bonds cannot be purchased on those terms the Trustee shall use available funds to call bonds for redemption. All bonds paid, redeemed, or purchased shall be cancelled.

$3,000,000 Leavenworth, Kansas, Toll Bridge Revenue 4 percent Bonds Due June 1, 1983

Whenever the sinking fund-surplus is $10,000 or more in excess of the amount required to pay the current interest becoming due on the next succeeding three interest-payment dates, it may be used from time to time for the purchase of bonds in the open market at the lowest price or prices obtainable, but not exceeding the price at which the bonds are redeemable on the next succeeding interest-payment date; provided however, that if on the forty-fifth day before any interest-payment date the amount of such excess available for the purchase of bonds and not so expended shall equal $10,000 or more, the Board of Commissioners shall proceed to call bonds for redemption so as to exhaust such excess as nearly as may be. All bonds so purchased or redeemed shall be cancelled.

$100,000,000 Delaware River Port Authority
Delaware River Bridges
4, 3, 3¼ & 3½ percent Bonds due December 15, 1957/1983

The Trustee shall purchase bonds at such times, for such prices, in such amounts and in such manner as the Trustee in its discretion

may determine and as may be possible with the amount of such moneys then available in the bond redemption fund, providing the price paid for any bond shall not exceed the principal amount, unless the bond may be redeemed in accordance with the resolution on any date within thirteen months after such purchase, in which event the purchase price shall not exceed the redemption price on any such date.

$285,000,000 New Jersey Turnpike Authority
Turnpike Revenue 3.20 and 3¼ percent
Bonds due January 1, 1986
Redemption price—103 to 1959 and declining premium thereafter

All moneys in the sinking fund shall be applied to the purchase or redemption of bonds. The purchase price of bonds purchased for the sinking fund may not exceed the aggregate principal amount thereof plus accrued interest to the date of purchase. If the unexpended amount in any sinking fund on any November 15 exceeds $250,000, such amount shall be applied, to the nearest multiple of $1,000, to the redemption of bonds on the next interest-payment date.

$46,400,000 Delaware Memorial Bridge
Revenue 4 percent Bonds due June 1, 1978

Whenever these shall be in the sinking fund bond retirement account, funds in excess of the interest reserve requirements, such funds shall be applied by the State Highway Department so far as is practicable, in purchasing bonds at the lowest prices obtainable with reasonable diligence, but not exceeding the price which would be required to be paid upon the redemption of such bonds. If however the amount of such excess moneys shall be equal to or greater than $200,000, the Department shall call for redemption on the next interest date such amount of bonds as, with the redemption premium, will exhaust such excess. Bonds shall thereupon be cancelled and shall not be re-issued.

$62,000,000 California Toll Bridge Authority
Richmond-San Rafael Bridge
Revenue 3⅞ percent Bonds due September 1, 1992

The Fiscal Agent shall apply moneys allocated to the sinking fund to the purchase of bonds at public or private sale when and at such prices as it may in its discretion determine but not to exceed the then current redemption price. If on any January 15 or July 15 the moneys in the sinking fund equal or exceed $50,000, such moneys shall be applied to the redemption on the next interest date of as many bonds as such money shall suffice to redeem at the redemption price prevailing.

In 1952, 53 million motor vehicles were registered in the United States and various sources predict 80 million by 1975. Road building, both by State Highway Departments and under the stimulus of newly created toll authorities, is proceeding at a rapid pace and it may be expected that the market stability of toll bonds will compare favorably with any other type of investment. A new tabulation of "Municipally Owned Toll Facilities", including projects completed in 1953 and giving comparative figures for the calendar year 1953, will be available in March, 1954.

MUNICIPALLY OWNED TOLL FACILITIES

COMPARISON OF ESTIMATED AND ACTUAL REVENUES

The following tabulation shows the earnings record of various municipally owned toll facilities during 1950, 1951 and 1952 compared with estimated earnings. The percentage figures given below indicate the ratio of actual earnings to estimate earnings.

Original Issue	*Outstanding*			*1950*	*1951*	*1952*	*Opened to Traffic*
$350,000 (11–1–38)	$350,000	Atchison County, Missouri Bridge Revenue 4¼% Due 11–1–58	Est'd	$34,480	$34,480	$34,480	12–12–39
			Actual	39,303	39,374	37,071	
				114.0%	114.0%	107.3%	
$2,150,000 (4–1–50)	$2,150,000	Bay Harbor Islands Florida Causeway Revenue 4% Due 4–1–90	Est'd			187,000	10–14–51
			Actual				
$2,800,000 (11–1–50)	$2,800,000	Bellevue Bridge Commission Bridge Revenue 4% Due 11–1–80	Est'd			101,500*	Est'd compl. date July 1952
			Actual				

*6 mos.

Original Issue	*Outstanding*			*1950*	*1951*	*1952*	*Opened to Traffic*
$12,400,000 (10–1–48)	$10,050,000	Burlington County Bridge Commission Bridge Revenue 3–3¼%. Due 10–1–52/73	Est'd	1,495,600	1,572,000	1,648,800	May 1931
			Actual	1,955,579	2,305,086	2,807,191	Acquired by City 10–22–48
				130.8%	146.5%	170.5%	
$1,970,000 (2–1–50)	$1,970,000	Burt County Bridge Commission Nebraska Bridge Revenue 3¼% Due 2–1–80	Est'd			155,600	Est'd compl. date Jan. 1952
			Actual	Waiting for Federal Government to change course of river.			
$2,775,000 (2–1–42)	$800,000	Cairo Bridge Commission Mississippi River Bridge Revenue 2–3%. Due 8–1–52/56	Est'd	216,700	222,600	222,600	Acquired by Comm. 3–22–42
			Actual	473,723	539,399	615,602	
				218.3%	242%	278.8%	
$1,800,000 (4–1–36)	Bridge Free (11–11–48)	Cairo Bridge Commission Ohio River Bridge Revenue 2¼%–2¾% Due 10–1–56	Est'd				
			Actual				11–12–38
$73,000,000 (1932)	$6,863,000 (12–31–51)	California Toll Bridge Authority S. F. Oakland Bay Bridge	Est'd				
			Actual	8,982,436	9,401,352	9,842,833	11–12–36
21,000,000 Ref. & Imp. Bds. Sold 1–12–52	19,000,000						
$8,350,000 (9–1–51)	$8,350,000	California Toll Bridge Authority San Mateo–Alameda Toll Bridges 2¼ and 2½%. Due 9–1–53/76	Est'd			1,147,000	Acquired by Authority 9–12–51
			Actual			1,365,005	
						119.1%	
$62,000,000 (9–1–52)		California Toll Bridge Authority Richmond–San Rafael Bridge Bridge Revenue 3¼%. Due 9–1–92	Est'd				Est'd compl. date July 1956
			Actual				
$1,911,000 (8–1–40)	$612,000	Cabell County, West Virginia Bridge Revenue 2¾% Due 8–1–51/65	Est'd				Acquired by City 8–1–41
			Actual	439,829	520,782		
$3,400,000 (10–1–46)	$2,864,000	Cape May County Bridge Commission New Jersey Refunding and Improvement 2¾%. Due 10–1–69	Est'd	328,000	334,000	340,000	Acquired by Comm. 12–4–46
			Actual	334,976	394,905	394,813	
				101.9%	118.0%	115.7%	
$2,370,000 (6–1–46)	$1,505,000	Cape Special Road District of Cape Girardeau County, Missouri Bridge Revenue 2¼ and 2¼% Due 6–1–52 to 12–1–60	Est'd	248,000	257,000	262,000	Opened 9–3–28
			Actual	334,167	345,053	427,729	Acquired by Dist. 6–20–46
				134.9%	134.1%	160.5%	
$12,500,000 (11–1–52)		Coastal Highway District, Georgia Savannah River 3¼% Due 11–1–82	Est'd				Est'd compl. date Nov. 1, 1954
			Actual				
$1,415,000 (12–1–40)	$1,330,000	Chester, Illinois Toll Bridge Revenue 4% Due 9–1–65	Est'd	135,000	139,000	142,000	8–5–42
			Actual	156,898	189,832	202,659	Destroyed 7–29–44
				115.5%	135.8%	142.2%	Reopened 8–24–46
$1,850,000 (12–1–37)	Bridge Free (6–1–51)	Dakota County, Nebraska Sioux City Revenue 1% Due 6–1–52/56					1–1–27
$1,136,000 (2–1–34)	$49,000	Davenport, Iowa (Iowa-Illinois Memorial Bridge) 2¼% Due 5–1–60	Est'd	166,920	166,920	166,920	11–18–35
			Actual	384,580	412,696	440,642	
				231.4%	247.8%	264.2%	
$46,400,000 (6–1–48)	$46,400,000	Delaware Memorial Bridge Revenue 4% Due 6–1–78	Est'd		1,750,000*	3,115,000	8–16–51
			Actual		1,758,186*	5,787,563	
					101.5%	185.5%	
					(*4½ months)		
$2,500,000 (8–1–36)	$29,500,000	Delaware River Joint Toll Bridge Commission (Easton–Phillipsburg Bridge and Trenton–Morrisville Bridge) 2.35% 1984	Est'd				Easton 1–17–38
			Actual	907,837	901,307	917,333	Trenton Dec. 2, 1952
							Portland-Columbia Delaware Water Gap Milford-Montague Jan. 1954

Original Issue	*Outstanding*			*1950*	*1951*	*1952*	*Opened to Traffic*
$6,300,000 (9–1–50)	$6,271,000	Denver–Boulder Turnpike Revenue 2¼%, 2.90 and 3% Due 9–1–56 to 1980	Est'd Actual			266,000 363,121 136.5%	1–20–52
$3,450,000 (2–1–51)	$3,450,000	Douglas County, Nebraska North Omaha Bridge Commission Bridge Revenue 3¼% Due 2–1–81	Est'd Actual				12–14–52
$2,800,000 (6–1–41)	$642,000	Dubuque, Iowa Bridge Commission Revenue 2.20 and 2.90% Due 1–1–65	Est'd Actual	300,000 458,723 152.5%	300,000 484,912 161.5%	300,000 516,697 172.0%	8–31–43
$11,000,000 (1–1–48)	$11,000,000	East St. Louis, Illinois Bridge 3¼% and 4% Due 1–1–78	Est'd Actual		835,000 653,453 78.3%	855,000 824,845 96.3%	1–15–51
$23,000,000 (2–1–50)	$23,000,000	Elizabeth River Tunnel Commission, Virginia Revenue 3½%. Due 2–1–80	Est'd Actual			1,850,000 1,339,000*	May 23, 1952
					*8 mos. to 2–1–1953		
$4,600,000 (11–1–48)	$4,600,000	Ocean Highway & Port Authority Toll Road 2½–3¼% Due 11–1–81	Est'd Actual	8,776	443,750 92,275 20.8%	453,000 162,621 35.9%	10–21–50
$2,500,000 (2–1–49)	$2,500,000	Glynn County, Georgia Bridge and Causeway Revenue 4% Due 2–1–79	Est'd Actual		189,500 193,552 102.0%	202,400 227,284 112.1%	6–9–50
$21,250,000 (9–1–51)	$21,250,000	Florida State Improvement Commission Lower Tampa Bay Bridge 3¼% Due 9–1–81	Est'd Actual				Est'd compl. date Jan. 1, 1955
$2,481,000 (11–1–39)	Bridge Free (11–1–50)	Greenville, Mississippi Revenue 2–2¼% Due 5–1–52/65	Est'd Actual				10–5–40
$16,000,000 (9–1–52)	$16,000,000	Jackson and Clay Counties, Missouri Paseo Bridge 3¼, 3 and 4% Due 9–1–82	Est'd Actual				Est'd compl. date Jan. 1, 1954
$1,808,000 (12–1–38)	$1,352,000	Jamestown Bridge Commission Rhode Island Revenue 2½% Due 12–1–69	Est'd Actual	160,000 211,776 132.0%	160,000 221,868 138.0%	160,000 242,448 151.2%	7–27–40
$2,300,000 (6–1–39)	$1,145,000 (1,995,000 Ref. & Imp. Bds. Sold in 1952)	Madison, Illinois Kingshighway Bridge 3½% Due 12–1–63	Est'd Actual	279,450 450,420 161.2%	284,050 521,414 183.7%	288,650 583,981 202.1%	7–19–29
$2,400,000 (2–1–39)	$1,783,000	Maine–New Hampshire Interstate Bridge Authority 2¼%. Due 2–1–69	Est'd Actual	184,000 239,444 130.0%	191,000 278,775 145.7%	198,000 397,506 200.0%	11–9–40
$20,600,000 (2–1–46)	$19,877,000	Maine Turnpike Authority Turnpike Revenue 2½ and 2¾%. Due 2–1–70	Est'd Actual	876,000 1,041,066 119.2%	908,000 1,217,301 133.9%	940,000 1,509,685 160.5%	12–13–47
$43,925,000 (10–1–48)	$43,007,000	Maryland Bridge Commission Chesapeake Bay Bridge 2½, 2¾, 3, and 3.20%. Due 10–1–52/72	Est'd Actual			2,400,000[1] 1,635,133[2]	7–30–52

[1] Also secured by revenue from Susquehanna and Potomac Bridges (1952 revenue—$3,144,493)

[2] 5 months

Original Issue	*Outstanding*			*1950*	*1951*	*1952*	*Opened to Traffic*
$8,400,000 (6–1–51)		Mississippi State Highway Commission Bay St. Louis Bridge Revenue Bonds 3¼%. Due 6–1–55/81	Est'd Actual				Jan. 1953
$3,500,000 (5–1–39)	$4,240,000	Mobile, Alabama Tunnel Revenue 2¾, 3¼% Due 11–1–52/78	Est'd Actual	590,000 599,520 101.5%	600,000 652,136 108.9%	615,000 742,562 120.5%	2–20–41
$27,000,000 (9–1–47)	$27,000,000	Mystic River Bridge Authority 2¾% Due 3–1–80	Est'd Actual	1,744,000* 1,144,401 65.8%	2,043,000 1,366,812 66.8% (* 10 months)	2,088,000 1,358,251 65.2%	2–27–50
$6,300,000 (3–1–50)	$6,300,000	Nassau County Bridge Authority Revenue 2¼% Due 3–1–75	Est'd Actual	464,235	451,000 494,058 109.1%	518,000 529,257 102.0%	Acquired by Authority 7–2–45 Reconstructed 5–10–52
$2,058,000 (12–1–38)	Bridge Free (9–26–52)	Natchez, Mississippi Bridge Revenue 1¼% Due 4–1–52/56	Est'd Actual	372,526	406,547	400,183	9–25–40
$868,000 (7–1–40)	$235,000	Nebraska City, Nebraska Bridge Revenue 1¾% Due 7–1–61	Est'd Actual	76,760 135,049 176.1%	77,000 141,983 184.5%	77,000 115,772 150.3%	10–12–30 Acquired by City 8–17–30
$285,000,000 (1–1–50)	$285,000,000	New Jersey Turnpike Authority Turnpike Revenue 3.20 and 3¼% Due 1–1–86	Est'd Actual			9,394,000 17,829,636 190.0%	1–15–52
$4,000,000 (1–1–40)	$2,700,000	Niagara Falls Bridge Commission Bridge Revenue 2¾% Due 1–1–70	Est'd Actual	347,000 592,673 170.9%	347,000 691,452 199.0%	347,000 743,529 214.0%	11–1–41
$1,700,000 (1–1–49)	$1,700,000	Nueces County, Texas Causeway Revenue 4½% Due 1–1–74	Est'd Actual	115,309*	375,000 174,443 46.5%	410,000 203,749 49.5%	6–17–50
					* Revenues assumed to accrue from 1–1–51		
$38,000,000 (8–1–50)	$38,000,000	Oklahoma Turnpike Authority Turnpike Revenue 4, 3½ and 3% Due serially 8–1–58/90	Est'd Actual				April 1953
$1,400,000 (8–1–38)	$561,000	Owensboro Bridge Commission Bridge Revenue 1½ and 1¾% Due 8–1–52/67	Est'd Actual	213,200	220,651	255,559	6–13–40
$40,800,000 (8–1–38)	$263,765,000	Pennsylvania Turnpike Revenue 2¼, 2½, 2.90 and 3¼% Due 1952/1988	Est'd Actual	7,570,000 8,511,153 112.5%	12,080,000 13,984,303 116.0%	17,478,000 20,173,737 115.3%	10–1–40 Phil. Ext. 11–20–50 Western Ext. Est. 12–26–51
$65,000,000 (9–1–52)		Pennsylvania Turnpike Delaware River Extension Revenue 2¾ and 3%. Due 6–1–82	Est'd Actual				Est'd compl. date Jan. 1955
$1,600,000 (12–1–50)	$1,540,000	Port of Hood River, Oregon Toll Bridge 3½% Due 12–1–75	Est'd Actual		137,500 155,934 113.2%	171,408	Acquired 12–12–50
$590,000 (7–1–49)	$367,000	Prairie Du Chien, Wisconsin Bridge Revenue 3½% Due 1–1–53/60	Est'd Actual	171,943 197,000 111.0%	175,314 197,893 112.5%	178,686 205,730 115.1%	3–7–32 Acquired by City 12–20–49
$435,000 (10–1–38)	$435,000	Richardson County, Nebraska Bridge 4½% Due 10–1–58	Est'd Actual	47,970 55,022 115.0%	48,510 52,536 108.2%	49,060 49,526 100.0%	12–20–39
$2,500,000 (2–1–39)	$1,561,000	Rock Island, Illinois Bridge Revenue 3% Due 2–1–70	Est'd Actual	333,300 307,604 92.4%	341,000 377,017 110.5%	348,700 428,929 123.0%	7–12–40

Original Issue	*Outstanding*			*1950*	*1951*	*1952*	*Opened to Traffic*
$2,757,000 (6-1-36)	$25,000	St. Charles County, Missouri Bridge Revenue 2¼% Due 6-30-56	Est'd Actual	 508,315	 392,026 (Lewis Bridge free 1-1-51)		7-19-28
$2,600,000 (10-1-40)	$2,148,000	St. Louis County, Missouri Bridge Revenue 2¼ and 2¼% Due 10-1-52/65	Est'd Actual	257,000 308,761 120.0%	259,000 340,631 131.1%	261,000 382,719 146.5%	12-11-44
$2,300,000 (6-1-36)	$606,000	State Bridge Commission of Michigan Port Huron Bridge 2.30% Due 6-1-68	Est'd Actual	 559,372	 551,178	 619,558	10-8-38
$326,000,000 (6-1-52)	$326,000,000	State of Ohio Turnpike Revenue Bonds Project No. 1 3¼%. Due 6-1-92	Est'd Actual				Est'd compl. date July 1, 1955
$96,000,000 (3-1-52)	$96,000,000	State of West Virginia Turnpike Revenue Bonds Series A 3¼%. Due 12-1-89	Est'd Actual				Est'd compl. date June 1, 1954
$3,050,000 (3-1-37)	$2,375,000	Thousand Island Bridge Authority Bridge Revenue 2% Due 3-1-76	Est'd Actual	328,000 415,562	328,000 482,855	328,000 533,102	8-18-38
	$215,000,000 (1-1-52)	Triborough Bridge and Tunnel Authority Revenue Bonds 1¼, 1¾, 2 and 2¼%. Due 7-1-57/69	Est'd Actual	14,878,000* 21,114,994* 142.0% *Includes all facilities	16,500,000 26,166,898 158.2%	17,900,000 29,278,695 163.5%	Tri—7-11-36 Bronx—4-29-39 Henry—12-14-36 Marine—7-3-37 Cross—6-3-39 Queens—11-15-40 Brooklyn—5-25-50
$7,000,000 (10-1-47)	$3,550,000	Warren County, Mississippi Bridge 2¼, 2½ and 3¼% Due 4-1-67	Est'd Actual	958,650 1,281,987 133.8%	977,900 1,374,182 141.1%	1,016,400 1,364,611 134.9%	4-28-30 Acquired by County 4-30-47
$3,050,000 (11-1-49)	$3,550,000	Wasco County, Oregon Toll Bridge Revenue 3½% Due 11-1-74	Est'd Actual		150,000 141,913 94.4%	169,177	Acquired Ferries 7-1-50
$5,500,000 (12-1-38)	Bridge Free (7-1-49)	Washington Toll Bridge Authority Lake Washington Bridge 1¼% Due 9-1-55	Est'd Actual				7-2-40
$14,000,000 (3-1-48)	$12,800,00	Washington Toll Bridge Authority Tacoma Narrows Bridge 3¼% Due 3-1-78	Est'd Actual	* 209,468	955,400 1,057,009 110.5%	984,000 1,144,104 116.3%	10-14-50
				*Revenues assumed to accrue from 1-1-51			
$3,650,000 (12-1-47)	$3,076,000	Washington Toll Bridge Authority Longview Bridge 3 and 3¼% Due 12-1-77	Est'd Actual	249,700 287,266 115.1%	297,187 322,818 108.5%	303,130 345,560 114.0%	Acquired by Authority 12-16-47
$1,650,000 (3-1-49)	Bridge Free (10-1-51) Ret. fr. State Hwy. Bds.	Washington Toll Bridge Authority Agate Pass Bridge 2½% Due 3-1-79	Est'd Actual	No estimate 15,699	 66,746		10-7-50
$6,800,000 (4-1-51)	$6,450,000	Washington Toll Bridge Authority State Ferry System 3¼% Due 4-1-66	Est'd Actual		3,707,100[1] 2,996,219[2]	4,657,500 5,206,098 112.0%	6-1-51
				[1]10 mos. [2]7 mos.			
$2,870,000 (3-1-41)	$510,000	Wheeling, West Virginia Bridge 3% Due 3-1-52/55	Est'd Actual	449,300 653,385 145.2%	452,700 629,199 139.0%	456,100 561,616 123.0%	3-25-41
$700,000 (12-1-46)	$300,000	Yankton, South Dakota Bridge 2¼, 2½ and 3% Due 12-1-52/57	Est'd Actual	115,000 156,694 135.6%	120,000 178,508 148.3%	206,115	10-1-24 Acquired by City 12-31-46

What Does the Motorist Expect of Today's Highway System?

K. B. RYKKEN

Mr. Rykken was for fifteen years associated with the Minnesota Department of Highways in its Division of Highway Planning. In 1950 he joined the staff of the American Automobile Association in Washington as its highway engineer. In 1952, he was made special assistant to the Executive Vice-President, stationed at the capital.

HISTORIANS variously estimate that the wheel was invented about 10,000 B.C. The subsequent joining of two wheels by an axle made inevitable the traffic quagmire we see all around us today in the United States. It is interesting that wheeled transportation, at least for the first several thousand years, was concerned primarily with the movement of goods rather than of people.

In those early days, man relied on his own feet, or on those of his faithful four-footed animal, to get from one place to another. One has but to look about him in this country today to realize that a tremendous re-emphasis on the movement of goods has developed during the last few years. As a matter of fact, the movement of goods over today's highway system poses a problem to the private passenger car owner which in his mind has reached staggering proportions.

For the first ten or eleven thousand years, progress in highway transportation was relatively slow. Historians of the eighteenth and nineteenth centuries record many instances of concerted effort aimed at developing a highway transportation system. However, it was not until the late nineteenth century and the coming of the automobile that the pattern of today's modern highway transport began most surely to evolve.

In 1900, the United States registered 8,000 motor vehicles—all passenger cars. Within a couple of years that number had risen to 23,000. The years 1899 and 1900 saw the organization of the first Good Roads Association in the State of Washington, which has been in continuous active existence since that time.

At the turn of the century, the first automobile clubs were organized, and in 1902 seven of those clubs banded together to form the American Automobile Association. These organized clubs consisted of private passenger car owners having one consuming desire —to see roads improved to the point where they could experience maximum enjoyment from operating those early motor vehicles.

The zeal and labor of those pioneers is almost unbelievable to the youngster of today, who thinks nothing of driving his or his father's automobile for seemingly endless miles over surfaced roads. When informed that his father or grandfather actually got out and built roads, filled mud holes, put up road signs and otherwise labored as a private citizen for better roads, the modern youngster shakes his head and indulges in the somewhat dubious statement, "They must have had holes in their heads."

When the history of the first fifty years of the twentieth century is finally written, it will most certainly record the development of the American highway system as one of the prodigious feats of engineering construction in recorded annals.

What was the motivating force behind these pioneers in the good roads movement? What caused them to sacrifice time and money for what was in those days a rather costly hobby? From talks with men of that era who are still alive, and from reading the things others have written, it can only be concluded that these men had a vision of things to come. They also most certainly had an immediate desire to expand their own horizons, to move from place to place throughout the land by conveyances they themselves could operate and control. All of these men possessed a burning interest in things mechanical. They were truly the pioneer tinkerers of the automotive age.

This doggedly persistent work on the part of pioneer car owners culminated in the great road-building era of the twenties and early thirties. To appreciate fully the almost incredible magnitude of that accomplishment, one has but to examine the following figures:

Year	*Motor Vehicle Registration*
1900	8,000
1910	468,500
1920	9,239,161

Year	*Motor Vehicle Registration*
1930	26,531,999
1940	32,035,424
1950	49,176,796
Present time	54,709,000

Nowhere is the productive genius of American industry better illustrated than in these figures.

Four Automotive Eras in 50 Years

It appears reasonable to divide the last fifty years into four major eras of highway transportation activity and interest. The pioneering period, both in automotive engineering and in highway development, took place from the late 1800s until about 1917. As the tempo of road building increased, the pattern of today's road system began to evolve. Continuous effort on the part of the people brought about state and federal government interest in highway development. World War I, in a fashion typical of all great wars, advanced automotive engineering rapidly. Motor trucks were built and their value in the nation's economy became apparent.

The second period, beginning after World War I and continuing until the early thirties, saw the great boom in road building. That relatively short period developed a system of roads without equal in the world. Automotive transportation became an economic force and an accomplished fact. During these years, America started to put itself on wheels.

It is almost tragic that by the end of this period a philosophy had developed in the minds of a majority of Americans that our road building job was done. Highway departments existed in every state in the Union. Highway engineering had developed into a profession of importance and challenge. The private citizen, who was paying the bill, almost literally shrugged his shoulders and turned the job over to government. Many car owners today will admit that this was one of the most serious mistakes of the last fifty years in highway transportation.

The third period in the evolution of highway transportation covers the years from the early thirties to about 1941 and the begin-

ning of World War II. During that brief time and in spite of a major depression, motor vehicle registration increased steadily. Great emphasis was placed on the movement of goods, and thus the history of 12,000 years ago began to repeat itself.

By 1941, many highway engineers clearly recognized that the real job of providing a highway system adequate to accommodate the demands placed upon it was only beginning. Those demands, measured in terms of numbers of vehicles and weights of commercial vehicles, gave eloquent warning of our road system's bursting at the seams, a condition which we see all about us today.

Highway engineers who in the early thirties had believed they could carry on without too much interest or help from the public now keenly realized they were greatly handicapped because the people who used the roads failed to grasp the magnitude of the job that lay ahead.

During World War II, highway development stopped almost completely. This period was an almost total vacuum in the evolution and development of our highway system. It is true that a substantial accumulation of plans during this period anticipated post-war development, but visionary as some of those plans appeared to be, they were for the most part wholly inadequate to meet the motor-vehicle deluge which engulfed this nation in the post-war years.

The fourth period, from 1945 to 1950, saw the most incredible expansion in automotive transportation. Registration increased during those five-years by 18,538,367. All America got behind the wheel of a passenger car or truck and placed a burden upon an already inadequate highway system which threatened critical breakdown.

During this lustrum also, through efforts of highway officials, motor clubs and other highway-user groups, the American people began to realize they were confronted with a problem of major proportions brought about by their own desires—and the zeal of the automotive industry.

America Rides on Rubber Tires

Automotive design improved by leaps and bounds. Advertising by industry assumed flowery proportions. The "air cushioned" ride, the car with the "comfort of your own living room," with speed and

power for any and all emergencies, was kept constantly before the American public. In this five-year period we substantially completed the job of putting the nation on rubber tires. Transporting people and goods by automobile and truck assumed proportions of an American heritage and a vital economic necessity. Retreat was not possible.

On the other hand, our cities were one gigantic traffic jam. Rural roads were crowded with passenger cars and commercial vehicles vying for traveling space with increasing ill temper and lack of understanding of each other's problems. The weekend joy-ride became acute misery to the driver of the family automobile. Without batting an eye, we killed 40,000 people each year on our streets and highways.

The passenger car owner who used that vehicle in his everyday business life, whether for long trips or for traveling to and from work, traveled in the menacing shadow of commercial vehicles which had assumed many of the proportions and characteristics of a boxcar. Claims and counterclaims resounded through our legislatures and Congress. Truly, America was awakening to the fact that even we could not have our cake and eat it too.

Modernized Highway System Begins

By the beginning of the mid-century, the almost frantic efforts of highway officials and organized highway-user groups to arouse the driving public from its highway lethargy began to bear fruit. Increasingly, the private citizen demanded to know what could be done about our traffic problem. The car owner, above all others, was dismayed and bewildered by the problem's scope and magnitude; he had almost completely ingored them for the last twenty years. When engineers placed before him estimates of the cost of modernizing our highway system, he was staggered.

Organized motor clubs, which had been striving desperately to bring these facts into focus for the automobile owner, were increasingly besieged by requests, demands in fact, for a remedy.

The average motorist's great desire for an adequate highway facility was dramatically demonstrated by the manner in which he

took to the toll road, paying a fee per mile for relatively free and uninterrupted travel often many times the contribution he made in motor vehicle taxes to the development of a free road system.

The reawakening interest of the motor vehicle owner in his highway problem was demonstrated in another way. States began the task of thoroughly evaluating their total highway needs through comprehensive studies. These studies were complemented by an evaluation of the financial problem. Methods of meeting the needs as set forth by comprehensive studies were explored.

Highway study committees in increasing number struggled to develop a program which could be presented to the public. As these programs were thrashed out and agreed upon, and in turn presented and explained to citizens of the states, there was demonstrated a support for, and a willingness to meet the cost of, a soundly developed and sensible program of highway improvement.

In too many instances programs were delayed too long because of the inability of groups represented on study committees to come to agreement. Perhaps nothing in the last few years has emphasized the vital importance of highway transportation in the nation's economy more than the difficulty in reaching agreement among those groups whose economic well-being was affected in some way or other by the financial requirements made clear by highway studies of this type.

Congestion Rated No. 1 Problem

There is reason to believe that the American people as a whole are ahead of their legislative representatives in their willingness to face up to the problem confronting them. Several months ago the American Automobile Association, through a number of its affiliated clubs, circulated a simple questionnaire to a random sample of drivers who visited automobile clubs. This was done in an effort to sample the thinking of the motor car owner on problems he deemed of greatest importance to him. Of necessity, these questions were rather broadly phrased. The sample was not large and was random in character.

It is interesting and significant that 88 percent of the people who filled out this questionnaire rated congestion in hearts of American cities as the most serious problem. Eighty-five percent indicated that

too much of this nation's road mileage is totally unsuited to today's traffic. Interesting and significant also is the fact that 67 percent of the completed questionnaires rated waste and misuse of road tax money as a serious or very serious problem.

This necessarily sketchy tracing of the evolution of highway transportation in this country has been presented for better evaluating the attitudes and desires of the private motor car operator today. Perhaps these attitudes can best be summarized by listing a series of questions.

1. What do most motor car owners think is needed?

The answer is obvious. He wants and needs more and better roads.

2. Is he willing to pay?

Evidence is rapidly developing that the motorist is willing to pay his fair share of the cost of needed highway improvements. He would insist, however, that these needs be carefully and realistically evaluated and that a financing program be developed that will require an equitable sharing of the burden by all classes of road beneficiaries. He increasingly demands that highway funds be used to do first things first. For the most part, car owners believe that political considerations and highway development cannot sleep in the same bed.

3. Will he tend to reduce or limit his driving?

Vehicle-mile records of driving since the war indicate some decline in the miles-per-year driven by the private motor car. In 1948 that annual average was 10,000 miles. In 1952 it had dropped to about 9,000 miles. These decreases undoubtedly stem from the unwillingness of many drivers to face the maelstrom of week-end traffic. It must be realized however that in increasing measure, mileage by passenger cars is of a business character, and there certainly will be no decline in this mileage.

4. Will he tolerate the banning of passenger cars from the main streets of American cities?

Anyone who has carefully studied the evolution of private motor car use in this country can only conclude that the American citizen will not tolerate any arbitrary limitation upon his right to use a motor car in any way he sees fit. You can no more regiment the

private automobile driver than you can regiment the American housewife in her choice of laundry soap.

No one in his right mind would presume to know everything the private motor car owner is thinking today with regard to his highway problem. Evidence is piling up, however, that the 45 million passenger car owners in America are rapidly awakening to the crisis which confronts this nation. It seems entirely probable that they recognize to a degree which legislators, highway officials and others do not realize, the need for immediate remedial action. There are also indications that our legislators have not as yet accurately measured the willingness of this great mass of car owners to face up to a problem, which by its very nature can be solved only through increased expenditures. That the private passenger car owner will expect equity in any approach to this problem is only fair and just, and the propriety of his attitude cannot be disputed by anyone in an official position.

New Zoning for an Old City

A. RUSSELL TRYON

Mr. Tryon has been with the Buffalo City Planning Commission since 1949. Previously he was engaged in the city planning field for ten years, and in 1940 won the American Academy in Rome National Fellowship Award in Landscape Architecture for the design of a model community. He is a member of the American Institute of Planners, the American Society of Civil Engineers, and the American Society of Landscape Architects.

ANY city having reached a mature stage, as Buffalo had, prior to the general acceptance of zoning regulations must be considered an "old" city for purposes of planning. This applies whether the planning be in the field of zoning, traffic, or building regulations. It does not mean, however, that an old city cannot be progressive and awake. Buffalo's adoption of a new, completely rewritten zoning ordinance and map indicates that this city is awake to its current problems and is willing to take bold action to cope with them.

Changes reflect a 1953 approach to zoning which was first adopted by Buffalo in January, 1927. This new approach recognizes that a modern ordinance, in Buffalo's case, must deal realistically with an area over 80 percent built up; that many of the buildings have been there for a hundred years or more; and that there is an extremely small proportion of undeveloped land. It also recognizes the established traditions of people in certain ethnic groups where such recognition does not work against the best interests of the entire city.

Although we in no way believe that the writing of the ordinance text, the preparation of the maps, and the careful reasoning that went into the new ordinance were secondary, we do believe that one of the most valuable lessons learned by local professional planners was in the process of successful passage. Many times—and initially here in Buffalo—too little thought has been given to the processes which implement the passage of a new law. A law, no matter how perfect, must have legislative approval or it joins a distinguished list of dust-catchers on municipal shelves.

From the experience of this city in its recent passage of a new zoning ordinance, we do not believe it is necessary to compromise or weaken a document, in order to achieve passage, to the point that it becomes an ineffective law. On the contrary, the only major compromise made in the Buffalo ordinance was strenuously opposed by five of the councilmen and, in the final debate prior to passage, the issue was not one of opposition to the ordinance as recommended but whether or not the new ordinance should require even more strict off-street parking regulations than recommended.

Public Must Know Facts

The average city legislator generally assumes that the ordinance text and maps will be well written and drafted. He is for it or against it, depending on how it affects him and his constituents. For this reason, in the preliminary draft stages of such an undertaking, sufficient publicity should be given to the ordinance to allow the councilman to see how his constituents think about the proposed change. In the case of Buffalo, this public orientation brought councilmen into the City Planning Commission offices where a large amount of the initial work was done. These first trips to the planning commission by councilmen were not to compliment us on the fine job but to complain about what we had done to them and their people. In some cases the constituents had legitimate complaints and there was a conscientious attempt to make changes whenever it was proved they were merited.

For the most part, however, this procedure will serve to give legislators a clear picture of the objectives of the new law and will invariably provide one or more champions of it in the legislative chamber. In Buffalo the councilmanic districts which provided the most opposition to the new zoning ordinance in its early stages also produced the best-informed councilmen on the subject. One was later to become chairman of a zoning subcommittee.

This committee was comprised of the following members: Three district councilmen, the chairman of the city planning commission, director of planning, city planning commission, director of buildings, and the secretary of the zoning board of appeals. In addition to

these originally appointed active committee members, the chairman requested that an assistant corporation counsel from the city law department attend to represent the city's legal staff, and that the director of planning from the county planning board also be asked to attend. The subcommittee was appointed on September 9, 1952. Eight months later, after holding public meetings every two weeks on all sections of the ordinance and going laboriously through these sections, word for word, the committee submitted its final report to the council on May 4, 1953. This report strongly recommended approval of the ordinance after certain recommended changes. In the meantime, excellent support developed in both local newspapers and the ordinance was passed on July 21, 1953 by the council and a week later became law with the mayor's signature.

Although the new ordinance contains changes in all of its sections, only the off-street parking and loading section will be discussed in this article. The new Section 17, shown below, consolidates all off-street parking and loading requirements. By such consolidation it recognizes that parking and loading are now major problems and merit a separate section regulating them. Cross references in the other sections of the ordinance are used freely, however, for added clarity. For the first time two local agencies most vitally concerned with traffic congestion and off-street parking problems are brought into the zoning administration where, under Section 17 A 4, the approval of the Board of Safety (Traffic Engineering) and the Division of Parking are required before the Zoning Board of Appeals can grant an exception to ordinance requirements.

The twelve zoning district classifications in the City of Buffalo, several of which are referred to in the parking section, are listed below:

R1—One-family district
R2—Dwelling district
R3—Dwelling district
R4—Apartment district
R5—Apartment-Hotel district
C1—Neighborhood Business district
C2—Community Business district
C3—Central Business district
CM—General Commercial district
M1—Light Industrial district
M2—General Industrial district
M3—Heavy Industrial district

SECTION 17—OFF-STREET PARKING AND LOADING

A. Parking and Loading Space: After the effective date of this amended chapter there shall be provided, *unless excepted by reason of compliance with*

Section 17 A (4) below, at the time of erection of any main building or at the time any main building is enlarged, off-street parking and loading spaces as hereinafter specified. Each off-street parking space shall contain not less than 160 square feet in the case of self parking and not less than 126 square feet in the case of attendant parking, exclusive of access drives or aisles which have adequate ingress and egress, and shall be of usable shape and condition. When provided on a site other than that containing the main building to which it is accessory, parking space shall be in a district where permitted and shall be subject to deed, lease or contract restrictions acceptable to the Corporation Counsel of the City of Buffalo, binding the owner to maintain the required number of parking spaces available to the occupants of the building to which they are accessory throughout the life of such building. Each off-street loading space shall be not less than 10 feet in width, 30 feet in length and 14 feet in height.

1. Parking Space for Dwellings—In all districts, except as hereinafter modified, there shall be at least one permanently maintained parking space for each dwelling unit, and one such parking space for each 2 guests or members residing on the premises of a lodging, rooming or boarding house, student dormitory, fraternity or sorority house, or private club; provided that in any "C" or "CM" district there need be only one such parking space for each 2 dwelling units. In all districts except "C3," hotel or apartment-hotel accommodations other than dwelling units shall have one such parking space for each 3 guest rooms or suites; in the "C3" district there shall be one such parking space for each 6 guest rooms or suites. Parking space as required above shall be provided on the same lot with the main building to which it is accessory or on a site within 500 feet of such building.

2. Parking Space for Buildings Other Than Dwellings—In all districts, except as hereinafter modified, permanently maintained off-street parking space shall be provided as follows:

Use	*Parking Spaces*
a. Theaters *(except in the C–3 district)* . .	1 for each 10 seats
b. Hospital, convalescent or nursing home .	1 for each 5 beds
c. Bowling alley	5 car spaces for each alley
d. Dance hall or skating rink	1 for each 100 square feet of gross floor area
e. Eating and drinking places, restaurant or bar *(except in the C–3 district)*	1 for each 150 square feet of gross floor area
f. Medical or dental office or clinic building in any R, C–1 or C–2 district	1 for each 250 square feet of gross floor area

Use	*Parking Spaces*
g. In the C–1 or C–2 district: individual retail store, or group of stores in a shopping center, designed as a unified building or development, having a ground floor area of more than 5000 square feet	1 for each 300 square feet of gross floor area
Individual retail store, more than 10,000 square feet gross floor area in any C–3, CM or M–1 district	1 for each 500 square feet of gross floor area
h. Other commercial or industrial buildings having a gross floor area of more than 10,000 square feet	1 for each 1000 square feet of gross floor area but need not exceed 1 for each 5 persons working on the premises

Parking space as required above shall be either on the same lot with the principal use to which it is accessory or on another site within 1000 feet thereof. Where different portions of a lot or building are occupied by uses having different parking requirements, the required parking for each such portion shall be computed separately and the results totaled. For purposes of computing gross floor area applicable in this section basement and cellar floor areas, not devoted to the principal building use or a use otherwise considered a parking generator for the purposes of this section, shall be excluded from the gross floor area.

3. Loading Space—On the same premises with every building or part thereof, hereafter erected, having a gross floor area of at least 10,000 square feet occupied for manufacturing, storage, furniture or household appliance store, department store or hospital, there shall be provided and maintained at least one off-street loading space plus one additional such loading space for each 50,000 square feet of gross floor area so used in excess of 50,000 square feet. Off-street loading space requirements for hotels, apartment-hotels, apartment or office buildings more than 3 stories high, shall be one-third the foregoing.

4. Exceptions—Where an exception to A (2) or (3) has previously received the approval and recommendation of the Board of Safety and the Division of Parking, the Zoning Board of Appeals may consider an application for an exception. The Board shall then hold a public hearing on the matter, at which it shall consider the recommendations of the above mentioned Boards of Safety and Parking and may then grant exceptions to the requirements of the

above subdivisions (2) or (3) if these exceptions are not less restrictive than the more restrictive recommendations of either of the above Boards and further provided that these exceptions are in accordance with conditions as listed below.

Conditions

a. If the owner or tenant of a building used for one or more of the purposes set out in Subdivision 2 above is participating in the financing and operation of existing parking facilities or facilities under construction, credit shall be given for future parking spaces as required by this ordinance in direct proportion to the degree financial investment is actually made in the above mentioned facilities.

b. In the determination of required parking spaces for an enlargement of a building which absorbs an additional existing structure, credit shall be given for the estimated amount of parking space which would have been required if the structure, taken over by the enlargement, had been erected after the effective date of this ordinance.

c. Parking space provided for one or more uses listed under Subdivision 2 above may be the same space provided for other uses specified in said subdivision if, in the opinion of the Boards of Safety and Parking, these spaces are actually available for use by a second parking generator which does not conflict with the use of the original building receiving credit for these parking spaces.

d. In the case of a building located in the C–3 district, and where the premises adjoin only one street, the off-street loading requirements of this section may be waived if, in the opinion of the Zoning Board, compliance would cause an unreasonable hardship.

B. Requirements for All Vehicle Parking, Parking Areas, Automobile Sales Areas and Service Stations: All off-street parking facilities shall be either contained within buildings or subject to the following requirements:

1. Screening—Off-street parking facilities for more than 5 vehicles shall be effectively screened on each side which adjoins or faces the side or rear lot line of premises used for residential purposes or situated in any "R" district. That part of the screening required by this subdivision which is situated within 60 feet of the street lot line of such adjoining lot, or as far back of such line as the rear of any dwelling on such adjoining lot, whichever distance is greater, shall consist of a solid fence or unpierced masonry wall not less than 4 feet or more than 7 feet high and maintained in good condition.

2. Minimum Distance and Set-backs. If on the same lot with a main building, a parking area for 1 or more vehicles shall not be located or permitted within the front yard or side street side yard required for such building. If not

on the same lot with a main building, the parking area shall not be closer to any street line than the depth or width of yard which would be required on such lot for a one-story main building. The screening required by subdivision (1) of this Subsection shall be set back from each street, the same as if it were a building wall, so as to observe the front yard and side street side yard requirements of this Chapter. No automobile service station shall have any pump, holder, or other equipment within 10 feet of any street line.

3. Surface of Parking Area—Every off-street parking area and access driveways thereto shall be surfaced with a durable and dustless material and shall be so graded and drained as to dispose of all surface water accumulation.

4. Lighting—Any fixture used to illuminate any off-street parking area shall be so arranged as to direct the light away from the street and away from adjoining premises used for residential purposes or situated in any "R" district. The intensity of lighting shall not be such as to interfere unreasonably with any premises in any "R" district.

5. Access to and from public streets shall be subject to approval by the Board of Safety.

6. Every parcel of land hereafter used as an automobile or trailer sales area or as an automobile service station shall be subject to the requirements of this Subsection and shall be considered, in the application thereof, as the equivalent of a parking area for more than 5 vehicles.

C. Restricted Business or Industrial Parking Lots in "R" Districts: The Common Council, after notice and public hearing and after receiving the recommendation of the Commission, may allow in any "R" district except an "R1" district, on premises which adjoin any "C," "CM" or "M" district, a restricted parking lot incidental to a business or industrial use. Such parking lot shall be subject to the conditions of Subsection B of this Section, to such conditions as may be imposed by the Council and to the following conditions and limitations:

1. Such parking lot shall be situated on any private land which has an area of not less than 6000 square feet and which for at least 50 feet abuts directly on, or is directly across a street or alley from, any "C," "CM" or "M" district.

2. Such parking lot shall be used solely for the parking of passenger automobiles only, and no commercial repair work, sales or service of any kind shall be conducted thereon.

3. Such parking lot shall be at all times subject to entry and inspection by representatives of authorized public agencies of the City of Buffalo in the performance of their duties.

4. Any permission herein granted by the Common Council is conditioned upon full and complete compliance by the permittee

with all the requirements of this Chapter and any additional requirements of the Common Council. Such full compliance must be complete and finished within not more than 6 months from the effective date of Council permission.

5. No use permit shall be issued to the permittee by the Director of Buildings based upon such Council permission until he has caused such premises to be examined and is satisfied that the permittee has fully complied with all the requirements of this Chapter and all the requirements and conditions of the Common Council. If the Director of Buildings reports to the Common Council that he is unable to issue such use permit within the 6 month period, because the permittee has failed to comply fully with the conditions of this Chapter and the conditions and requirements of the Common Council, then such permission of the Common Council, conditionally granted, thereupon becomes immediately void and of no effect.

D. Community Garages in "R" Districts: The Common Council, after notice and public hearing and after receiving the recommendation of the Commission, may allow in any "R" district except an "R1" district (even on an otherwise vacant lot) a community garage for any number of self-propelled vehicles, subject to such conditions as the Council may impose and to the following conditions and limitations:

1. Such garages shall conform with the requirements of Sub-section (8) of Section 16, General Provisions, for accessory buildings in "R" districts.

2. Not more than 20 percent of the vehicles parked in any such garage or on such premises shall be commercial vehicles. No vehicle exceeding 8 feet in width or height or 1½ tons capacity shall be parked in any such garage or on such premises.

Studying the Unified Approach to Traffic Safety

WALTER A. CUTTER

Mr. Cutter is assistant director, Center for Safety Education of New York University, with which he has been affiliated since 1942. Previously, he was for three years educational specialist for North Carolina's Highway Safety Division. A writer and lecturer on various aspects of industrial and motor vehicle safety, Mr. Cutter directs the evening course program of industrial and traffic safety courses at New York University's Center for Safety Education, and is coordinator also of military training program classes each year for the Department of the Army, and U. S. Air Force. He is advisor to the Department of the Army on accident-prevention training.

IF THE nation's medical and public health measures to combat epidemic and filth diseases had been of the same nature and scope as our national efforts to alleviate another national disease—traffic accidents—we should not be enjoying immunity from these diseases today. Because accidents are a form of social sickness, it is instructive to compare methods of treating this sickness and methods used to treat physical illnesses.

In the case of "accident-sickness"—traffic accidents in this case—we have been successively or simultaneously (1) unperceptive as to the true nature and the scope of the problem (that is, many past diagnoses have been superficial, inexact, and hurried); (2) unaware, through faulty analysis, preferring to rely on opinions, hunches and prejudices, of the problem's specific elements and the relative weight of these elements; (3) unwilling to put known remedial techniques to work in a unified and intelligent fashion, striking at the bases of the problem, and using these remedial techniques in a way and to that degree dictated by the problem's outlines in a given area at a given time; (4) failing to organize the job; (5) and backward in training administrators. We tend still to stand around waiting for "gimmicks" of one kind or another, looking for ideal solutions, or

rushing in with ill-considered, abortive measures, while remedial measures of known value are waiting only to be put to work.

Medical and public authorities, though not always uniformly foresighted, once alerted to the tremendous potential in coordinated preventive and control techniques, went to work with a will and their accomplishments as well as our benefits have been truly magnificent. What are the broad outlines of their program? These are the steps:

1. Organize to do the job
2. Train men to do the job
3. Identify the disease
4. Determine the causes
5. Discover the cures
6. *Use in appropriate combination, all remedial elements and agencies which should be employed in effecting the cure.*
7. Maintain thereafter a consistent continuing preventive and corrective program (as the patient may relapse.)

In the case of an actual epidemic, and we might well think of traffic as a mobile epidemic, the procedures follow the general plan outlined above:

1. Locate the sources of infection and put in control measures.
2. Isolate active cases until they are cured.
3. Use such general prophylactic measures and such agencies as may be indicated necessary to accomplish the task.

Once again, all agencies which should be used are used by the medical authorities, and the normal devices for enlisting public support are set in motion. One final point is that overt disobedience of quarantine and similar regulations is punishable by law, law to which the mass of people does not object, because its intent is to guard their welfare and their lives.

A final point, to emphasize our analogy, is that state health departments use a unified attack. These departments keep records of births and deaths; they are active in securing needed legislation; they maintain records of accident facts; they inspect and enforce; they have extensive educational programs, and they take measures to enlist public support. Their programs are fine examples of coordination.

It would seem that this same general method is applicable to traffic accidents, and, if followed to the same degree, should be attended by the same results. It is true that people fearful of a disease are in a different and perhaps more receptive frame of mind towards control measures than are people in fear of traffic accidents; but what interests us is the validity of the *method* of preventive medicine and epidemiology rather than the obvious fact of these psychological differences.

What Is the Problem?

The basic, irreducible problem in achieving accident-free traffic is: How can nearly 55,000,000 motor vehicles, which we have at present, move safely on our streets and highways? Whether our individual primary interest is in car design, engine design, road construction, signs, signals, markings, motor vehicle administration, the driver, or traffic engineering, we may agree that this is the basic problem.

Our answers to this problem have tended to fall into three time-honored categories known as the three E's, Engineering, Education and Enforcement. These banners have been moved high and they have had some value. It is now recognized that this analysis of the problem represents an oversimplification of what is needed. Even if it were possible to force into one or another of these categories all the measures, procedures and practices we need to achieve traffic safety, the three-E approach is no longer adequate because other essential activities have as much validity as each of the E's.

However, our major point is not primarily the adequacy or inadequacy of the three-E approach, but another. Our major contention is that even if the three E's are all that are necessary, our states, cities and communities have but rarely *combined* these resources into an effective attack which goes to the roots of the problem. What we have seen, and what we now see all too frequently, is a series of *independent,* completely uncoordinated efforts which, insofar as other available resources are concerned, might just as well be exerted in a vacuum. The military establishment has recognized the necessity of unifying its three major branches into one effective striking force, but most of our states have not recognized a similar

necessity. We still have individual empires in our motor vehicle departments, state police forces, courts, and departments of education. Each does what it feels it should do and, unhappily, this estimate varies from place to place; but each does it alone mostly for the dubious reason that it has always been done that way, or that the incumbents prefer it "that way."

A moment's reflection will bring these frequently observed situations to mind:

1. States and localities where one or another of the three E's has a preponderant emphasis, because of the aggressiveness of a particular department plus the lack of aggressiveness of other departments.
2. Similar locations where as little communication, not to mention cooperation, as possible exists between vitally concerned departments.
3. Occasions where one or another of these basic E's goes off alone on an ambitious campaign for traffic safety and sacrifices the considerable resources of other departments.
4. "Headline Hunting," where the criterion for entering into a valuable activity is "What kind of a press will we get out of it?"
5. "Safety by the Ton" approach with large amounts of generalized materials distributed to little advantage.

One could multiply these examples—and make them even more concrete and circumstantial—but any instructed person in the field needs no convincing that there is all too frequently not only a lack of coordination in our efforts toward traffic safety but a definite lack of desire to cooperate.

There is temptation always to dip into history and try to show how these situations have developed; but we are here concerned with effects, and with the situation as we now find it. More particularly we are concerned, and hopefully, with all we can do about traffic accidents. In the new day and in the new effort, many will have to change viewpoints, opinions and prejudices, but that will be all to the good. The situation we face today in traffic is so serious, and represents such a threat to the well-being and economic and social health of the country, that the utmost in cooperative planning and activities will be demanded from all agencies concerned.

To summarize to this point in the understatement of the age: What we have done so far for traffic safety has not been enough. We have improved the fatality rate, but we kill more people. What we haven't done is incredible. What we *can* do is stimulating and hopeful.

What We Need to Do

The foregoing considerations have led the Center for Safety Education to envision a fresh approach to the whole problem. We cannot describe this as a new approach; there is little that is new about it as a concept. What may be new is the use of the concept.

Let us first adopt a premise. Our premise is that we know enough now about how to decrease traffic accidents if this knowledge were to be put to work in an intelligent unified fashion; that we could decrease traffic accidents drastically and cumulatively, and thus increase safety in traffic movement. What is more, we will have to do this if we are to obtain the greatest benefits from the use of motor vehicles.

Our concept then, is that if

1. We analyze and study the shape and precise nature of the traffic problems where we are, and range the factors of these problems in an order of importance, and if

2. We take the valid procedures that have been and can be used to achieve greater safety, and if

3. We study these procedures and resources in terms of the contribution each can and should contribute to the solution of the problem, and if

4. We evolve a master plan based on the successful mobilization and use of all these available resources, plus other needed resources which can be developed and brought into play; and if we put this plan to work and keep working it, varying the plan as is dictated by changing conditions and new situations, and if

5. We reappraise constantly both the problem and our program in terms of its adequacy and accomplishments, then

6. We will attain greater traffic safety because we shall be working for traffic safety in the only methodical way we can use to attain it.

What Are the Elements in a Unified Program?

Here we will follow the divisions of the "Annual Inventory of Traffic Safety Activities" of the National Safety Council.[1] This Inventory is chosen, first because its divisions include the essential activities and second, because the states of the country are familiar with it. The essential elements in the Inventory are:

Death and Injury Record
Traffic Legislation
Accident Facts
Traffic and Highway Engineering
Traffic Law Enforcement
Driver Licensing (includes examining, improvement and control)
Periodic Motor Vehicle Inspection
School Traffic Safety Education
Public Information (this is actually public safety education).
State Safety Organization

It is not essential for the purposes of this discussion to analyze each of these constituent elements. Each has a *prima facie* right to inclusion. Conversely a complete program could not afford to omit any one of them. We may notice that this list, as we consider each item and its importance, shows the inadequacy of the three-E approach.

It is obvious that no single one of these constituent parts is in itself equal to the job that needs to be done. Nor is a combination of a few of these elements sufficient. Experienced men in the field of traffic safety see more and more that we need a full-scale, sustained program, and not the partial, uncoordinated program encountered in most states. We find most often a heavy emphasis on enforcement, or education, or public support, or record systems and analyses. One

[1] The Inventory is an annual appraisal of traffic safety activities in the states of this country, in which each state's accomplishment in the several divisions of the Inventory are compared with the desirable and the proved good. While the Inventory does not show the relationships between the activities reviewed, such a relationship is implied, and a skillful administrator will see that to achieve the maximum effect possible, these separate divisions, separated simply for the purposes of analysis and comparison, will have to be combined into a unified program.

reason for this condition is the aggressiveness of one or another group, for example, the enforcement arm or the educational forces. Another reason is that in most states a number of departments are charged with responsibility for some part of the traffic problem, and these departments tend to follow their mission independently with little regard for what other departments may be doing. Some states have made healthy progress in coordinating their activities, while in others coordination is of a purely formal and non-productive type. There is good reason to believe, however, that the concept of a united attack is growing— stimulated sometimes by sheer desperation.

An Eleventh Element—Programming

To the ten elements in the Annual Inventory of Traffic Safety Activities, should be added a most important element, the eleventh: thorough training in the devising, organization, and administration of such full-scale traffic safety programs as are here recommended. To replace the partial, imperfectly organized and intermittent activities which go under the name of "programs" in so many places, there must be a new concept in developing programs. We must see programming for traffic safety as an indispensable adjunct to the knowledge heretofore recommended as essential. Programming may be described as the expert arrangement and use of available resources. If there were such a person as a program specialist and if we hired him for the job of creating an adequate traffic safety program, he would of necessity have to learn the full range of subjects discussed here, because to develop a program he would have to know what he had available to include in it. We are saying, therefore, that the type of men we have in mind as essential to traffic safety must have not only full knowledge of all the individual resources, but they must know what to do with this knowledge, how to apply it, translating knowledge into effective activity.

This is programming and our training program should feature it.

Three Essential Steps

To achieve a truly unified and adequately coordinated program, certain steps are necessary:

First, the states must be convinced of the common-sense validity and desirability of such a unified program.

Second, each state must establish appropriate policy to initiate such a program.

Third, persons must be thoroughly grounded in every aspect of the traffic-accident problem, and trained to the basic philosophy and procedures of a unified program. This training should include detailed knowledge of each of the ten elements shown in the Inventory, the possibilities and limitations of each. A first essential of coordination is knowing the elements to be coordinated. Too few persons in too few states know in thorough fashion the full range of our available resources, or how to combine and how to administer these resources.

It is interesting in this connection that very little training is available at present for administrators of traffic safety programs. Of the men participating in a workshop held at New York University to help plan the program of training discussed later in this article, several were trained educators; one, a trained traffic engineer; several, trained in enforcement; several were originally newspaper men with many years of experience in traffic safety, while others had varying backgrounds. A considerable number of years of combined experience was represented, yet every man said that over and above such formal training as he *may* have had in his specialty, all of his broad experience in traffic safety had been garnered by the trial-and-error method. This is an expensive method in time and effort. There has been some tendency in the postwar years to analyze our problems, and do first things first, but the tendency needs strengthening.

General Practitioner or Specialist?

It is at the point of training men and women in this knowledge and in what to do with it that the university enters the picture. The staff of the Center for Safety Education at New York University believes in the validity of this concept of a desirable unity and coordination of all state, municipal and public resources in meeting the problems of modern traffic. To test the concept, and to get advice and suggestions on what a man ought to know to be qualified to operate such a program, or to assist and advise in such a program, the Center

for Safety Education in July, 1953 convened a workshop composed of leading figures in traffic safety. For a solid week, eight hours a day, the whole question was discussed. In the very first hour, there was unanimous approval of the idea that we need a specifically trained man to assist states and municipalities in conducting such a program. The rest of the time therefore was spent in discussing the practical and essential content of such training. A suitable outline for a course program embodying this material is now in process of preparation. When approved, and when all necessary arrangements have been made, this program of training will be offered by New York University as a contribution to greater traffic safety. Announcement will be made in the near future.

It was agreed that the man we had in mind was the general practitioner type as opposed to the specialist. The specialist has an important place in our modern world, but specialists are not doing the size job that needs to be done chiefly because the efforts of these specialists are not combined and coordinated. In a medical clinic where a man is given a complete physical examination by a group of specialists, he might be in very bad case if at the end all the findings were not studied in relation to each other so that indicated treatment might be prescribed for the whole man. We need men who can work with the experts, and who can take the findings of the experts and weave them into a coherent and effective program which will deliver a planned volley rather than scattered fire.

Efforts in recent years by the American Medical Association to re-establish and rejuvenate the general practitioner are significant. A general practitioner is useful to the point where the need for a specialist is clearly indicated; he is useful in working with the specialist, and with the patient when the specialist's work is finished. This *type* of practitioner, with appropriate training, could be equally useful in the traffic field. Frequently the best use of specialists and their knowledge can be made by men looking at the whole picture who can fit the contributions of the specialist into it to achieve the best results.

It is fitting to acknowledge the contributions of those who participated in what it is hoped may have been an historic conference. The Center for Safety Education, which initiated the workshop re-

ceived full cooperation from the staff of the Traffic Institute, Northwestern University represented by Gerald O'Connell, and from the Bureau of Highway Traffic, Yale University, represented by Wilbur S. Smith.

Maxwell Halsey, executive secretary of the Michigan State Traffic Commission, served the workshop as both discussion leader and participant, as did William M. Greene, director of the Connecticut Safety Commission, and Dr. Herbert J. Stack, director of the Center for Safety Education. Present also as participants and contributors were the following, designated to attend by the governors of their states:

Colonel J. James Ashton, manager of the Delaware Safety Council; James R. Barrett, chief of the Police Bureau, Division of Safety, Executive Department, State of New York; Paul E. Burke, director of the Maryland Traffic Safety Commission; Deputy Commissioner Kennard E. Goldsmith, New Hampshire Motor Vehicle Department; Captain William Groth, safety engineer, Virginia Department of State Police; Allen E. Hawkes, director of research, Rhode Island Registry of Motor Vehicles; Alfred T. Little, of the Massachusetts Registry of Motor Vehicles; Max Schmidt, administrative assistant, Governor's Highway Safety Advisory Committee, State of Pennsylvania; Arnold Vey, director of the Bureau of Traffic Safety, New Jersey Department of Law and Public Safety; and Leo Welch, deputy director, Bureau of Traffic Safety, New Jersey.

Where Will General Practitioners Fit?

It is easy to answer this question if we follow the sense of the old saying that "each point in the world is a center of the world." At each location or in each state department, in each public or private agency, concerned with the traffic problem, where this philosophy of the united and coordinated approach to traffic safety exists, or where this philosophy can be developed, there is a place for a person trained in the manner described. A suggested listing of institutions, departments and agencies will show there is no dearth of opportunities for such men.

Any university or college with a department devoted exclusively

or in a major degree to the traffic problem would do well to include instruction in the coordinated approach to traffic safety, in addition to its own specialized instruction. For example, the Center for Safety Education is concerned primarily with the educational aspects of traffic safety, although some material from these other areas has always been included in its courses. Were we to broaden the emphasis on training in this coordinated program, our graduates would continue to have their specialization in education, but would have knowledge of all other divisions of the total traffic safety program.

Such knowledge would aid them effectively in their own work because their educational activities would be carried on in the light of the work of all other departments and agencies concerned with the problem. Similarly, a knowledge of the coordinated program by these educational specialists would make them more willing to combine their efforts with all other constructive efforts, because they will have been convinced of the virtues of such combined programming and unified activities. What is true of educational specialists is true of all other specialists working in the field of traffic safety.

State Traffic Safety Commissions

State Traffic Safety Commissions[2] are a comparatively recent development, and it may be prophesied that more and more states will adopt this comprehensive form of organization as an effective means of dealing with traffic accidents. Such commissions are either established directly by the legislature, or by the governor under powers granted by the legislature. It is their province to deal with the whole problem of traffic safety. Usually composed of public-spirited, nonsalaried members who have an interest in traffic safety, these commissions have a salaried executive and staff. The executive may be hired from the outside, or may be a member of an established department—the motor-vehicle department for example—who has been designated to work with the commission.

A man trained in all aspects of traffic safety would obviously be

[2] The 1946 President's Conference on Highway Safety recommended State Officials' Traffic Safety Committees made up of key department heads, but such committees have not been generally effective.

of the utmost value to a commission, supplementing the members' interest and enthusiasm with his professional knowledge, acting as liaison between state departments and public and private agencies, and translating the commission's policies into an effective program.

There is immediate need for promising persons to understudy the present leaders in traffic safety, men who have garnered an immense amount of experience, which would admirably supplement the proposed course of training and allow the program to go on uninterruptedly when a change of executives occurred. The alternative to this orderly change is a period of arrested motion while the new incumbent is learning the ropes.

As is well known, each state department's program is an important part, but only a part of the total effort necessary. A trained man as proposed here could well be a staff member of any state department: Bureau of Motor Vehicles, State Highway Patrol, Departments of Education, State Road and Engineering Departments, and others. Working under the director, he could assist in the most effective integration of a particular department's assigned responsibilities into a total program.

The same situation exists here as in state governments. Although this training course at first will be concerned primarily with state programs, the municipal program, with some modifications, is a miniature of the state program, and the proposed training course could be adapted by interested administrators to the problems of municipalities.

Trained persons in municipalities[3] would also help to correct another tendency of cities, particularly larger ones, to withdraw in "(un) splendid isolation" from statewide programs, because the city fathers view their problems as unique and needing more exceptional remedies than a given state could provide. Perhaps it is too much to hope that one training program will substantially modify this tendency, but a cadre of trained men who can convince a city that its problems are but part of a larger whole, may start all of our governmental divisions on the road to intelligent cooperation.

Safety councils, chambers of commerce, automobile dealers, in-

[3] For example, where a municipality has a traffic engineer with the requisite breadth of viewpoint he could be a natural organizer of the unified approach discussed here.

surance agents' associations, and other organizations state and local —with a substantial interest in traffic safety—would benefit individually from such trained persons on their staffs, while their efforts in cooperative enterprises would be immeasurably improved and accelerated. No effort has been made to list all the departments and agencies that could profit from the services of trained men. We have set down some of the major departments and agencies which would benefit; there are doubtless many other places. The job is a big one and will take a great many persons. The job can be done if we train enough men and give them a chance to work.

Where Will Students Come From?

It is anticipated that persons interested in the planned training will come from these major areas:

1. State traffic commissions.
2. State departments concerned with traffic safety. These may include present functioning personnel who wish to broaden their training, as well as those who need training to succeed present personnel.
3. Any other public agencies with traffic safety responsibilities.
4. Private agencies and associations, such as state safety councils, wishing to improve the quality of their contribution to traffic safety.
5. Young men and women of promise, who after training will be employed by some agency or department concerned with traffic safety.

It should be stated in conclusion that this plan does not envision either the establishment of a super-agency or a superman. Rather, we may look upon the plan and the men and women to be trained, as common denominators who can help to merge our fractional efforts into effective accomplishment.

The alternative to some basic and concerted and continuing effort is what we now have—a group of excellent remedial resources riding off in all directions, winning little battles here and there, and losing the war.

We have within our hands now the power to make a fundamental attack on the whole traffic problem. To aid in this attack we will

need more and more trained persons. Trained personnel will not be enough, however, without public understanding and support of what they are trying to do. So, citizens of every state must be mobilized to support measures that compel all our agencies to unite in a remedial program equal to the size and complexity of the problem.

Unless we attack, and quickly, on all fronts two other eventualities may become certainties. The first is progressive strangulation of our cities and states by the motor vehicle which began as the servant and now is rapidly becoming the master.[4] The second eventuality, in the absence of concerted programs by the forty-eight states, is federal regulation which will begin in an advisory, and end in a regulatory capacity.

We can halt both these trends now. We can win the battle for smooth, safe traffic. All we need—and it is a big order—is to unite our efforts, pool our knowledge, and use our full strength constantly. We cannot fail to win, if we will to win!

[4] As a matter of striking coincidence, when this paper was finished, the writer was listening to a radio news broadcast with this the first item: "A study has shown that New York City's traffic blight is costing business and the motoring public one billion dollars a year."

THE ENO FOUNDATION FOR HIGHWAY TRAFFIC CONTROL

THE BOARD OF DIRECTORS

COLONEL ROBERT C. F. GOETZ, U.S.A. Retired, *Chairman and President*
COURTLAND KELSEY, Attorney, New York, N.Y., *Vice President*
CHARLES M. UPHAM, Consulting Engineer, Washington, D.C., *Vice President*
GEORGE PARMLY DAY, *Yale University*
ALBERTA A. DRAYTON
PHILIP K. SMITH, New York, N.Y., *Treasurer and Assistant Secretary*
MARY S. BRIODY, *Secretary and Assistant Treasurer*

ROSCOE ELLARD, Director of Instruction, Graduate Journalism Faculty, Columbia University, New York, N.Y., *Editorial Consultant*
WILBUR S. SMITH, Associate Director, Bureau of Highway Traffic, Yale University, New Haven, Connecticut, *Technical Advisor*
ROBERT E. SCHMIDT, *Resident Traffic Engineer*

THE BOARD OF CONSULTANTS

Terms Expire February 1954

J. A. ANDERSON, Commissioner, Dept. of Highway, Commonwealth of Virginia
EDGAR F. COPELL, Commissioner, Metropolitan District Commission, Boston, Mass.
MAJOR GENERAL PHILIP B. FLEMING, Ambassador to Costa Rica; formerly, Chairman, the President's Highway Conference, Washington, D. C.
MAXWELL HALSEY, Executive Secretary, Michigan State Safety Commission
PAUL HOFFMAN, Chairman of the Board, Studebaker Corporation
THEODORE M. MATSON, Director, Bureau of Highway Traffic, Yale University
CHARLES M. NOBLE, Chief Engineer, New Jersey Turnpike Authority

Terms Expire February 1955

FREDERICK P. CLARK, Planning Consultant, Rye, New York
RANDOLPH COLLIER, California State Senator, Sacramento, California
WILLIAM ENO DEBUYS, Baltimore, Maryland
W. L. GROTH, Department of State Police, Virginia
NORMAN KENNEDY, Associate Engineer, Institute of Transportation and Traffic Engineering, University of California
T. E. TRANSEAU, Bureau of Highway Safety, Pennsylvania
LIGHT B. YOST, Director, Field Operations Section, General Motors Corporation, Detroit, Michigan

Terms Expire February 1956

FRED BURGGRAF, Director, Highway Research Board, Washington, D. C.
NATHAN CHERNIACK, Economist, The Port of New York Authority, N. Y.
F. BRUCE CRANDALL, President, Institute of Traffic Engineers; Traffic Engineer, Oregon State Highway Dept.
THOMAS DESMOND, New York State Senator, Newburgh, N. Y.
D. C. GREER, State Highway Engineer, Texas Highway Department
BURTON W. MARSH, A. A. A., Washington, D. C.
B. D. TALLAMY, Supt., N. Y. State Dept. of Public Works, Albany